NOVEMBER, 1916 15 CENTS

The Electrical Experimenter

POPULAR ELECTRICAL NEWS ILLUSTRATED

★ LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION

Brandes "Transatlantic" Head Set
Complete with head band, $10. A set for general professional long distance use. 2800 ohms.

Brandes "Navy" Head Set
A *de luxe* set, guaranteed the best made for professional use. 3200 ohms. Price $14.

Brandes "Superior" Head Set
Complete with head band $5.50. A professional set, within the means of every amateur. 2000 ohms.

"I Heard the Signals, Standing Ten Feet from the Receivers"

writes a purchaser of Brandes Wireless Receivers. "I think that is some stunt," the writer continues. It IS "some stunt." The remarkable sensitiveness of Brandes radio head sets is due to the two perfectly matched receivers, which pick up the weak signals and strengthen them. Also to the general excellence of Brandes workmanship.

If you're not enthusiastic about Brandes receivers, return them within 10 days and your money will be cheerfully refunded.

Send 4c for Catalog E, containing full information.

C. BRANDES, Inc., Wireless Receiver Specialists
Room 814, 32 Union Square, NEW YORK

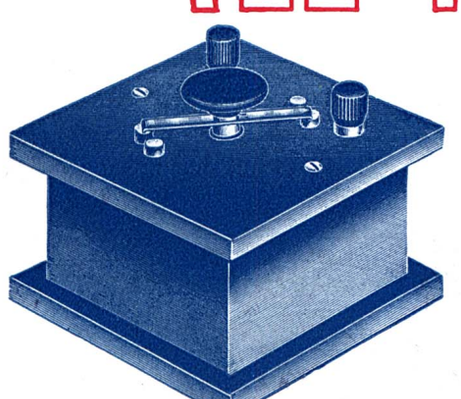
BRANDES WIRELESS RECEIVERS

The Receivers with Matched Tone

PERMANENT

TEL-RADION CO.

WIRELESS DETECTOR

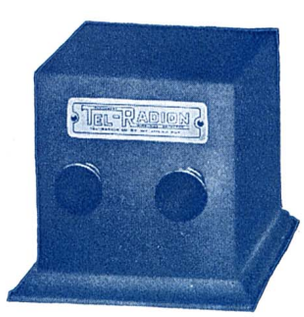


Send for Bulletin E

Describing improved types of loose couplers and time signal stations.

Now Half Price

RADIO STATIONS OF THE WORLD—This little vest pocketbook formerly sold for 50c a copy. We have only a few left which we will sell at 25c each. Contains the call letters of all commercial wireless stations of the world; alphabetically arranged.



DUPLEX TEL-RADION

EXPERIMENTING and EXPERIENCE have developed some great improvements in our TEL-RADION PERMANENT WIRELESS DETECTOR.

We have produced two new types of detectors which meet all requirements and conquer all the difficulties experienced with other detectors.

Our new DUPLEX TEL-RADION is a wonder. It enables the operator to attune separately to local or long distance stations by merely turning the rotary switch. Close tuning is instantly accomplished without disturbing the connections or changing the adjustment. It is like having two detectors, one sensitive, the other super-sensitive, but combined in one.

WITH THIS IMPROVED INSTRUMENT WE RIVAL THE HIGHEST PRICED AND MOST COMPLICATED DETECTOR ON THE MARKET.

The DUPLEX TEL-RADION is enclosed in a highly polished solid mahogany cabinet, size 4½ by 4½ by 3 inches and equipped with a duplex rotary switch, with all metal parts heavily silver-plated.

Though we have increased its sensitiveness and efficiency by several hundred percent, we have not increased the price which remains as before.

BY PARCEL POST PREPAID **$5.00**

FOR PERMANENCE, RELIABILITY AND ULTRA-AUDIBILITY YOU SHOULD BUY THE DUPLEX TEL-RADION PERMANENT DETECTOR.

TEL-RADION JUNIOR

The TEL-RADION JUNIOR is also a new and improved instrument involving the same invention and construction as the DUPLEX TEL-RADION except that the duplex feature is not included.

Our object in producing the Junior type is to enable you to secure a sensitive and efficient PERMANENT DETECTOR suitable for all ordinary purposes, at as low a price as you must pay for the ordinary detectors that require constant attention, twisting and adjusting and lack the fundamental quality of permanence. Enclosed in a Flemish finished solid oak case, with composition binding-posts.

THE PRICE OF THE TEL-RADION JUNIOR PARCEL POST PREPAID **$2.00**

A VERY EFFICIENT INSTRUMENT IS THE TEL-RADION JUNIOR

REMEMBER WHICHEVER INSTRUMENT YOU SELECT OUR GUARANTEE APPLIES TO EITHER. MONEY BACK IF NOT SATISFIED.

A TEL-RADION PERMANENT WIRELESS DETECTOR (EITHER OF THE ABOVE DESCRIBED TYPES) IS GUARANTEED PERMANENT AND RELIABLE. IT IS A MARVEL AT ELIMINATING STATIC.

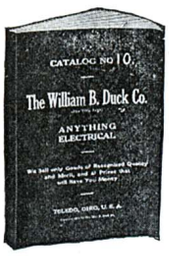
NO BATTERIES REQUIRED
NO OPERATING EXPENSE
EASY TO OPERATE
NO LOST MESSAGES

NO DELAYS OR INTERRUPTIONS
ALWAYS RELIABLE AND EFFICIENT
IT NEVER FAILS YOU FOR AN INSTANT
NO SET SCREWS OR FINE ADJUSTMENTS

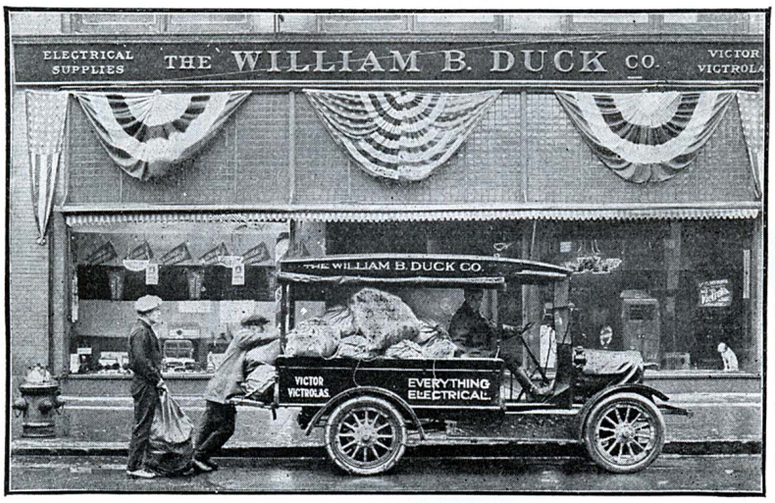
TEL-RADION CO., 32 Union Square, New York City

DUCK'S NEW BIG No. 10 300-PAGE ELECTRICAL and WIRELESS CATALOG

MORE THAN EVER JUSTIFIES YOUR VERDICT
THAT IT IS THE *ONE* CATALOG WORTH WHILE



15,000 of our catalogs ready for delivery to eager electrical and wireless enthusiasts in all parts of the world. One of ten consecutive shipments of catalogs to our patrons during last November.



150 pp. Wireless Instruments.

150 pp. Electrical Supplies.

Over 40 pp. of Wireless Instruments.

Only 8c. in stamps will bring this unrivalled catalog to your home. The great cost of catalog and the exceptionally low prices (oftentimes fully 25% below usual retail price) prohibits its distribution otherwise. You may deduct the 8c. on first $1.00 purchase.

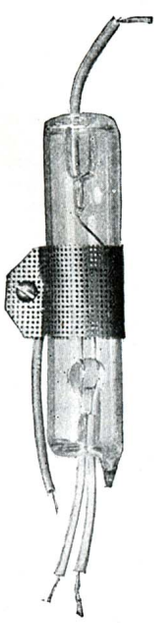
WHAT OUR BIG CATALOG CONTAINS

150 pp. Wireless Instruments, magnet wire of all kinds, raw material, storage batteries, telegraph instruments, battery motors, commercial motors and generators, sewing machine motors, telephones, step-down transformers, massage vibrators, bells, push buttons, auto accessories, flash lights, hand lanterns, auto and miniature lamps, Xmas tree outfits, voltmeters, ammeters, lighting plants, Victrolas, air rifles, electric aeroplanes, model builders, electric railways, electrical and mechanical books and general electrical supplies.

The William B. Duck Co., 230-232 SUPERIOR ST. TOLEDO, OHIO

The Moorhead Tube

Patent Pending



The MOORHEAD tube must not be confused with the two member valve, as it is inoperative without the outer electrode, or do not class it with the Trons or three member detectors as it is far more sensitive than either, in fact it is the most constant, stable and sensitive detector that has been developed.

A wonderful feature of the Moorhead tube is the static elimination. On the nights when static make the reception of stations with the ordinary detector impossible, the Moorhead tube brings the signals in with a marvelous clearness.

The initial cost of the Moorhead tube is low when the guaranteed long life is considered, and the fact that each Moorhead tube is a guaranteed

DETECTOR, AMPLIFIER and OSCILLATOR

SPECIAL INTRODUCTORY PRICE UNTIL JAN. 1, 1917

$6.50 PREPAID AND DELIVERY GUARANTEED

WE REPLACE ANY DEFECTIVE TUBES WITHOUT QUESTION

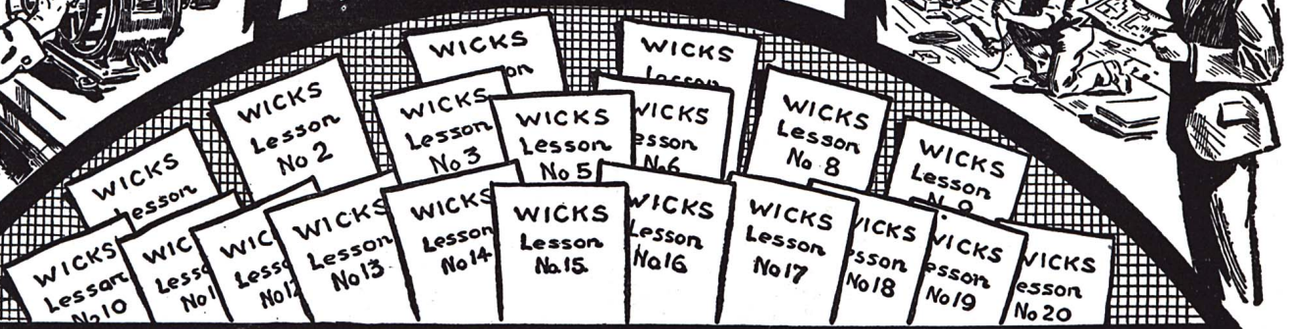
Write for circulars on the MOORHEAD tubes and Special sets

Pacific Research Laboratories, Sole Manufacturers

PACIFIC LABORATORIES SALES DEPARTMENT

534 Pacific Building **SAN FRANCISCO, CALIF.**

LEARN ELECTRICITY AT HOME


WICKS Lesson No 2
WICKS Lesson No 3
WICKS Lesson No 5
WICKS Lesson No 8
WICKS Lesson No 13
WICKS Lesson No 14
WICKS Lesson No 15
WICKS Lesson No 16
WICKS Lesson No 17
WICKS Lesson No 20

FREE! 20 COMPLETE LESSONS

Write me at once—TODAY! Just send the coupon or a postal. I will give you 20 complete lessons in **practical** electricity FREE! Think of it! My personal and individual instruction for 20 lessons without a cent of cost to you if you act quick. No charge to you for these 20 lessons now or later. I make this sensational offer to secure a few more live students—to show, too, how quickly I can make you a **Master Electrician** no matter where you live, or what you do. But you **must** act at once! This offer closes in 23 days! Remember these free lessons are **not** merely sample lessons, but are a regular part of my full and complete course in electricity. Send the coupon without delay—TODAY!

Earn $2,500 to $4,000 a Year

You can now qualify **at home** during your spare time, and without giving up your present position or occupation, for that most wonderful of all fields open to the ambitious man—the great and growing field of **Electricity!** Yes, no matter if you don't know a thing about electricity or never had a bit of electrical experience, I will take you in hand and make you an **Expert Electrician** so that you should easily earn **$2,500 to $4,000 a year and more.** And I'll do it so quickly and with so little effort on your part, that you'll wonder how it was possible. No books or tools to buy.

A. W. WICKS, E. E.

Formerly with the General Electric Co.; former General Manager of company manufacturing Jenney Electric Motors; also formerly with Fairbanks, Morse & Co.; now Consulting Engineer and Director of the Wicks Electrical Institute.

I Train You By Mail!

I will instruct you personally—make the whole matter so simple for you that you can't help but learn. When you have finished my instructions you are an **Expert Electrician**—ready to take a big paying job or start in for yourself. I show you not only how to do practical electrical work, but how to estimate on jobs so that you can take contracts at big profits. That's what it means to be trained by a man of my practical experience.

Men Wanted

Wherever you go there's always urgent demand for **Expert Electricians** and at big pay. That's because the watchword of the age is, "DO IT ELECTRICALLY." The field of electricity is broadening so fast that there's a big shortage of competent electricians. And the demand is increasing every day.

Mail Coupon Today

A. W. WICKS, E. E., Director, Wicks Electrical Institute
81 W. Randolph St. Dept. 226 Chicago, Ill.

Without any obligation to me whatever, please send me full description of your personal instructions in Electricity and particulars of your special offer of 20 of your lessons free.

Name.....

Street and No.....

City.....State.....

YOU MUST ACT QUICK

Mail coupon today. I want to hear from you immediately. Don't miss my offer of 20 personal lessons free. Remember this offer is strictly limited to 23 days. Write for all particulars at once. **Here's your chance!** No obligation to you. Send coupon or postal NOW!

A. W. WICKS, E. E., Director
Wicks Electrical Institute
81 W. Randolph St., Dept. 226 Chicago, Ill.

The Electrical Experimenter

233 Fulton Street, New York.

Published by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer; M. Hymes, Secretary), 233 Fulton Street, New York

Vol. IV Whole No. 43 CONTENTS FOR NOVEMBER, 1916 No. 7

FRONT COVER—"LIGHTNING MADE TO ORDER." From a painting by George Wall.
WIRELESS AND AEROPLANES AID EUROPEAN "GUN SPOTTERS" 469
HOW ELECTRIC CURRENT CONTROLS GREAT "MOVIE" BATTLE SCENES 470
ELECTRICITY IN THE TREATMENT OF INFANTILE PARALYSIS 471
THE TELEPHONE VALUABLE IN TARGET PRACTICE..... 472
ELECTRIC DEVICES HELP THE HOUSEWIFE..... 473
LIGHTNING MADE TO ORDER..... By Samuel Cohen. 474
MOVIE CONCERN BUILDS PORTABLE ELECTRIC PLANT.... 477
UNCLE SAM'S NEW 40-MILE AN HOUR ELECTRIC BATTLE-CRUISER.....By H. Winfield Secor and Arthur C. Doyle. 478
DR. CHARLES P. STEINMETZ (Our Supplement feature)..... 481
NEW ELECTRICAL METHOD OF CLEANING SILVERWARE—A HELP TO MOTHER..... 482
THE SPERRY 1,280,000,000 C.P. SEARCHLIGHT THROWS BEAM OVER FIFTY MILES..... 484
THE MARVELS OF MODERN PHYSICS..... By Rogers D. Rusk, B.Sc. 485
BARON MÜNCHHAUSEN'S NEW SCIENTIFIC ADVENTURES. By Hugo Gernsback. 486
WHEN AMATEUR WIRELESS WAS YOUNG....By H. de Scott. 488
RADIO LEAGUE OF AMERICA..... 489

Radium and Evolution

IF we place a thermometer into a phial containing a minute quantity of Radium Bromide, it will indicate a temperature 2.7 degrees hotter than the temperature outside of the phial.

What the temperature would be if we substituted Radium for Radium Bromide, we have no means of knowing. For science has not as yet produced pure Radium, although the lay world prefers to think so. Our closest approach to Radium so far has been Radium Bromide, which *if pure* consists roughly of three-fifths by weight of the element Radium and two-fifths of the element Bromine.

Turning back to our thermometer we also make the discovery that the heat radiated from our speck of Radium Bromide does not grow less as the days and months, nay years and centuries, roll by. The mysterious element continues to furnish prodigious amounts of energy, with never a let up, or at least not until it has "worked" for 2,500 years—this being the present calculated age of Radium.

In order to better comprehend what this means, let us compare it with coal. This is what we find:

According to Professor Soddy, a gram of pure Radium evolves 133 calories of heat per hour. In one year (8760 hours) the same gram of Radium evolves 1,160,000 calories. In 2500 years—the length of time Radium will evolve energy—2,900,000,000 calories will be developed. Now, one gram of coal when burned evolves 2,200, *net,* calories of heat. Consequently, the energy developed by Radium is more than a million times that furnished from the combustion of coal.

Commercial Radium salts are at present obtained by working the Austrian Pitchblende and lately from the American Cornotite found in Colorado. These are practically the only commercial sources known today.

But Radium is by no means as scarce as most people believe. Radium emanations have been found in springs, in the air, in rocks, etc., and this has given rise to an extraordinary theory regarding the evolution of the worlds.

When the famous Swiss-Italian Simplon tunnel was constructed some years ago, totally unforeseen circumstances arose which made the work most difficult. Although this tunnel is far above sea level, the heat became unendurable as the work progressed. Artificial cooling had to be resorted to in order to allow the workmen to proceed with their work. Professor Joly then made the astounding discovery that the rocks of the Simplon contained Radium, which accounted for the unexpected high temperature within the mountain.

From this Joly has built up a new theory of evolution and while revolutionary in the extreme it is most plausible and gains more adherents each year.

Lord Kelvin already deduced that if the earth contained only two parts of Radium per million million—and a great deal more is actually found in the rocks and crust of our globe—this minute quantity would raise the temperature of the earth's core 1,800° C. in one hundred million years. There being no escape for the imprisoned heat—the earth's crust being an exceedingly bad heat conductor—Professor Joly convinces us that as the ages roll by, the interior of the earth must become hotter and hotter. Finally, after the end of millions of years, the crust must give way to this tremendous heat from within and the bursting earth must go up in flames, becoming a burning gas ball, just as we see our sun today.

This will be the "incandescent age," a title suggested by Professor Soddy. After another tens of million years the incandescent earth will have expended all of its heat into space by radiation and it gradually will cool. A new crust then begins to form anew. This is what we see at present on the planets Jupiter and Saturn, worlds just beginning to cool after emerging from their incandescent age.

Thus we find that worlds do not die. They slowly pass from one stage to another, in a long and interminable cycle. It is more than probable from the above that the earth must have passed many times through this cycle. Probably every time the world went up in flames, man was at his highest point of civilization, infinitely further advanced than we are today. In an instant every living soul had perished and for millions of years his like was not to tread again on the hardened earth crust.

This is the new and greater gospel of Radium, the element which will emancipate man and which will destroy him and his all later.

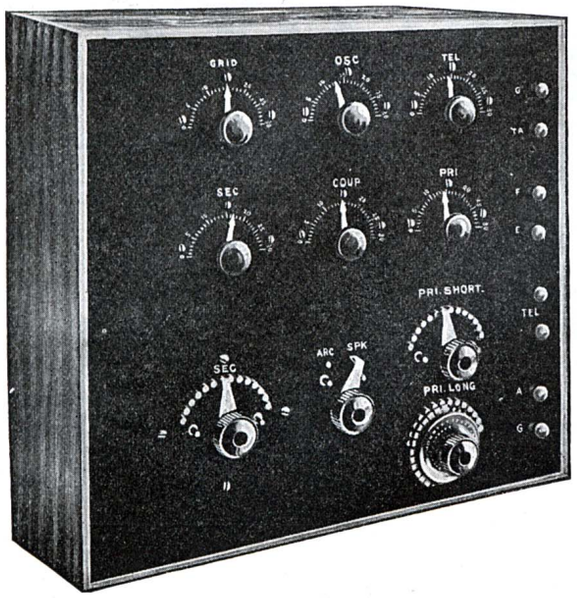
H. GERNSBACK.

THE ELECTRICAL EXPERIMENTER is published on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $1.50 a year in U. S. and possessions. Canada and foreign countries, $2.00 a year. U. S. coin as well as U. S. stamps accepted (no foreign coins or stamps). Single copies, 15 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of THE EXPERIMENTER PUBLISHING CO., INC. If you change your address notify us promptly, in order that copies are not miscarried or lost. **A green wrapper indicates expiration. No copies sent after expiration.**

All communications and contributions to this journal should be addressed to: Editor, THE ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full return postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

THE ELECTRICAL EXPERIMENTER. Monthly. Entered as second-class matter at the New York Post Office, under Act of Congress of March 3, 1879. Title registered U. S. Patent Office. Copyright, 1916, by E. P. Co., Inc., New York. **The contents of this magazine are copyrighted and must not be reproduced without giving full credit to the publication.**

THE ELECTRICAL EXPERIMENTER is for sale at all news stands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris. Western Advertising Office, 58 E. Washington St., Chicago, Ill.



Type "A S A" Receiver

A new receiving set of the most modern type. Wound with "Litzendraht" wire, primary dead end switch. Wave lengths 400 to 15,000 meters, panel type, all adjustments and connections on the front. Mahogany case.

Price $150.00

OUR NEW CATALOG X

of apparatus, "A little better than the best," displays in attractive form many improvements recently incorporated in a product already remarkable for its reliability during ten years of successful manufacture. We shall continue to give our customers prompt service, courteous treatment and apparatus which will be permanently serviceable. Catalog X of radio apparatus and general catalog of electrical apparatus and parts will be mailed upon request for which we ask the courtesy of 6c stamps to cover mailing both books.

CLAPP-EASTHAM CO.

141 Main Street

CAMBRIDGE - - MASS.

WE ARE HEADQUARTERS FOR ELECTRICAL AND WIRELESS GOODS

OUR NEW AMCO NAVY TYPE LOOSE COUPLER HAS MADE A TREMENDOUS HIT

PRICE $15.00

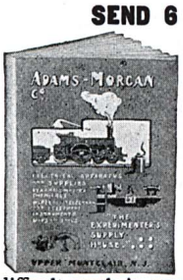
THE NEW AMCO NAVY TYPE LOOSE COUPLER embodies the most recent advances in the design of receiving transformers. High frequency resistance loss, capacity loss and leakage have been cut down by the use of special materials and methods. The primary winding is enclosed in a cabinet, the sides and top of which are polished black FORMICA, giving a finish and having insulating qualities far superior to hard rubber. FORMICA is also unbreakable.

Two 13 point switches on the front, control the primary by groups of several turns and by single turns respectively, thus giving a variation of from *1 to 156 turns in steps of one turn at a time.* The secondary is wound with a special silk covered wire. The ends are polished FORMICA. A very fine adjustment of the secondary is secured by a 12 point switch. This coupler is adapted to both short and long wave reception, and we guarantee it to be superior in every respect to any other coupler on the market or your money back.

Order one of these instruments today, keep it 10 days, and then if you don't like it send it back and we will refund your money by return mail

OUR NEW BIG 232 PP. UNRIVALLED ELECTRICAL AND WIRELESS CATALOG IS THE EXPERIMENTER'S REFERENCE BOOK

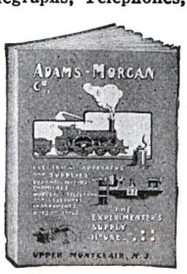
SEND 6 CENTS FOR OUR CATALOG. DO IT TODAY



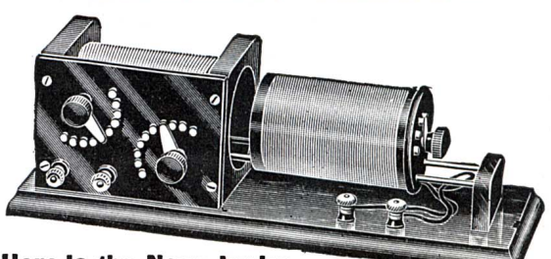
The latest edition of our famous catalogue is just off the press. Send 6 cents in stamps for a copy right away. It contains 232 pages and is fully illustrated. Complete description and prices of all the latest electrical, wireless and experimental apparatus, Storage Batteries, Rectifiers, Transformers, Spark Coils, Wireless Apparatus, Lamps, Flashlights, Meters, Books, Tools, Dynamos, Motors, Railways, Wires, Supplies, Telegraphs, Telephones, Model Aeroplanes, etc.

OUR PROMPT DELIVERIES WILL SAVE YOU TIME AND OUR PRICES WILL SAVE YOU MONEY

This catalogue shows several hundred parts and sets of materials for building your own apparatus at home. We do all the difficult work in our factory and you can put the parts together with the aid of a screwdriver and a pair of pliers. This catalogue is worth more to you than all other catalogues put together and you are doing yourself an injustice if you do not send for it right away.



IF YOU ARE BUILDING SOMETHING WE HAVE JUST WHAT YOU HAVE BEEN LOOKING FOR



Here Is the Navy Junior

Loose couplers in which the primary is variable by means of switches instead of a slider have become so popular that we have brought out this wonderful little instrument to meet the demand at a medium price. The primary is fitted with a genuine hard rubber panel across the front. Two ten-point switches are mounted on the panel. One switch controls the primary winding in groups of ten turns at a time while the other switch controls one turn at a time. The primary is therefore easily and quickly adjusted in steps of one turn at a time by the rotary motion of two knobs.

The secondary is variable by means of a multi-pointed switch, controlled by the same handle that varies the coupling. The secondary is carried on two rods and slides with easy movement in and out of the primary. The proportions of this tuner have been worked out by careful experiment and is very efficient. The instrument is beautifully finished in dark mahogany, with gold lacquered brass trimmings.

PRICE ONLY $7.50

ADAMS-MORGAN CO. THE EXPERIMENTERS SUPPLY HOUSE **13 Alvin Pl., Upper Montclair, N. J.**

WE ARE HEADQUARTERS FOR ELECTRICAL AND WIRELESS GOODS

THE ELECTRICAL EXPERIMENTER

H. GERNSBACK EDITOR
H. W. SECOR ASSOCIATE EDITOR

Vol. IV. Whole No. 43 NOVEMBER, 1916 Number 7

Wireless and Aeroplanes Aid European "Gun Spotters"

WHILE it has been considered for a long time in military circles that aeroplane wireless was certain to prove extremely valuable eventually, from all aspects, it is only within the past few months that we have heard anything definite in this direction.

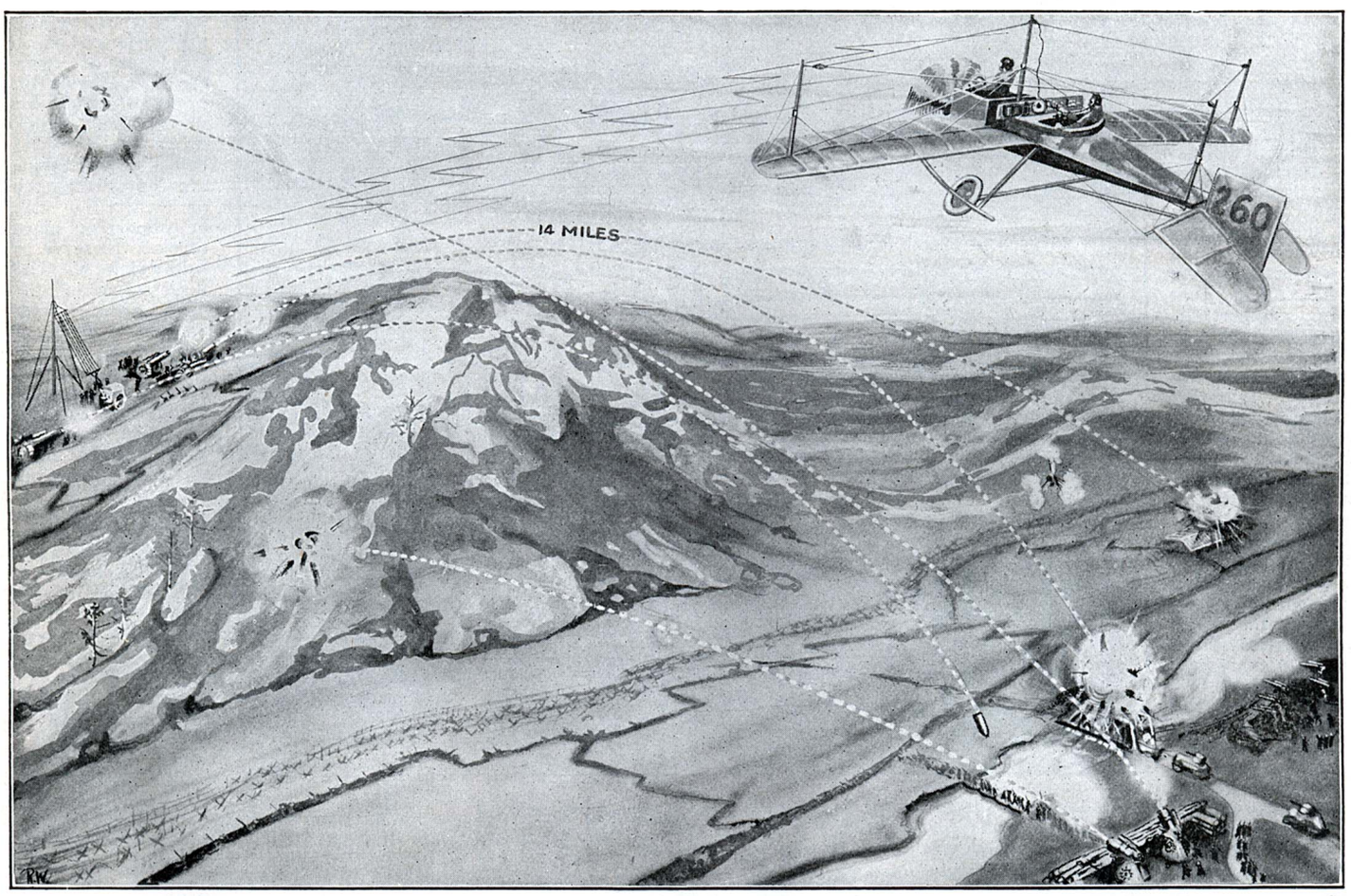
The Allies, according to reports received from the battle-fronts, "somewhere" in France," have found a number of ingenious uses for the radio equipped aeroplane. One of these is to accurately locate (or "spot") and report the effect of shell firing over considerable distances, as clearly shown in the accompanying illustration. The manner in which this scheme operates in the instance reported is as follows:

Behind the French lines there is erected a collapsible radio mast and the proper signaling equipment capable of keeping up communication with the distant *shell-spotting aeroplanes*. The high-powered battleplanes, each of which is equipped with a radio set capable of transmitting up to 30 or 40 miles, sail forth, and though they fly at a fairly great altitude, the aerial observers are quite able to accurately observe the resultant effects of the shell fire.

One of the reports states that a certain French battery of artillery actually succeeded in dropping four shells in succession on a bridge 14 miles away. The officers in the aeroplane helped to bring about this truly marvelous accuracy of fire by signaling back the exact effect of the bombardment to the commanding officer behind the French lines, via radio.

While this scheme may seem hazardous in the extreme, especially where the enemy is plentifully supplied with modern anti-aircraft guns capable of hitting aeroplanes or Zeppelins at remarkable heights, it seems that the French aviators have a way of obtaining this most valuable information without undue risk to themselves or their machines.

Undoubtedly the aviator may now and then lose his life, or at least be captured by the enemy, but by flying at a great altitude it seems he has been able to safely obtain this much needed information and to signal it to the artillery officers, in a number of cases which are on record.



The French Gun Batteries are Reported to be Planting Successive Salvos on Points 14 Miles Distant, with Machine-like Accuracy. An Aeroplane Fitted with Wireless Apparatus Flies over the Enemy's Position and Signals Back the Result of Each Shot.

It goes without saying that in any such case as here cited, where the range is as great as fourteen miles, that those in charge of the guns cannot very well see the structure to be demolished from their position except in rare instances. It often happens that such firing is to take place over a hill, as shown in our illustration. Firing over

(*Continued on page 533*)

How Electric Current Controls Great "Movie" Battle Scenes

BEHIND the staging of a tremendous motion picture *battle scene* lie innumerable details of executive technical skill and in some of these electricity is depended upon for essential results. An instance of this is in the work of the *explosion man,* as he is called by the Photo-play directors. To him the use of a battery and wires and detonator is as important as to the engineer of any colossal public work. The only difference is that the movie explosion man's effects are theatrical instead of practical.

In the recent filming of a big battle scene in Commodore J. Stuart Blackton's "The Battle Cry of War" on Staten Island, the explosion expert, with his trusty little detonator, was a most important factor in the spectacular success of the action. Herman Rottjer, in charge of explosions for Vitagraph films, staged bursting shells, gas attacks and subterranean mines realistically with a touch of his finger on the electric key. Totally inconspicuous on the side lines of the battlefield, this expert executed explosions timed to the fraction of the second, and without the injury of a single person among the hundreds that charged and struggled across the terrain where scores of powder caches lay scattered. All this was managed successfully, ending with a climax of a mine explosion that consumed three hundred pounds of the explosive at once.

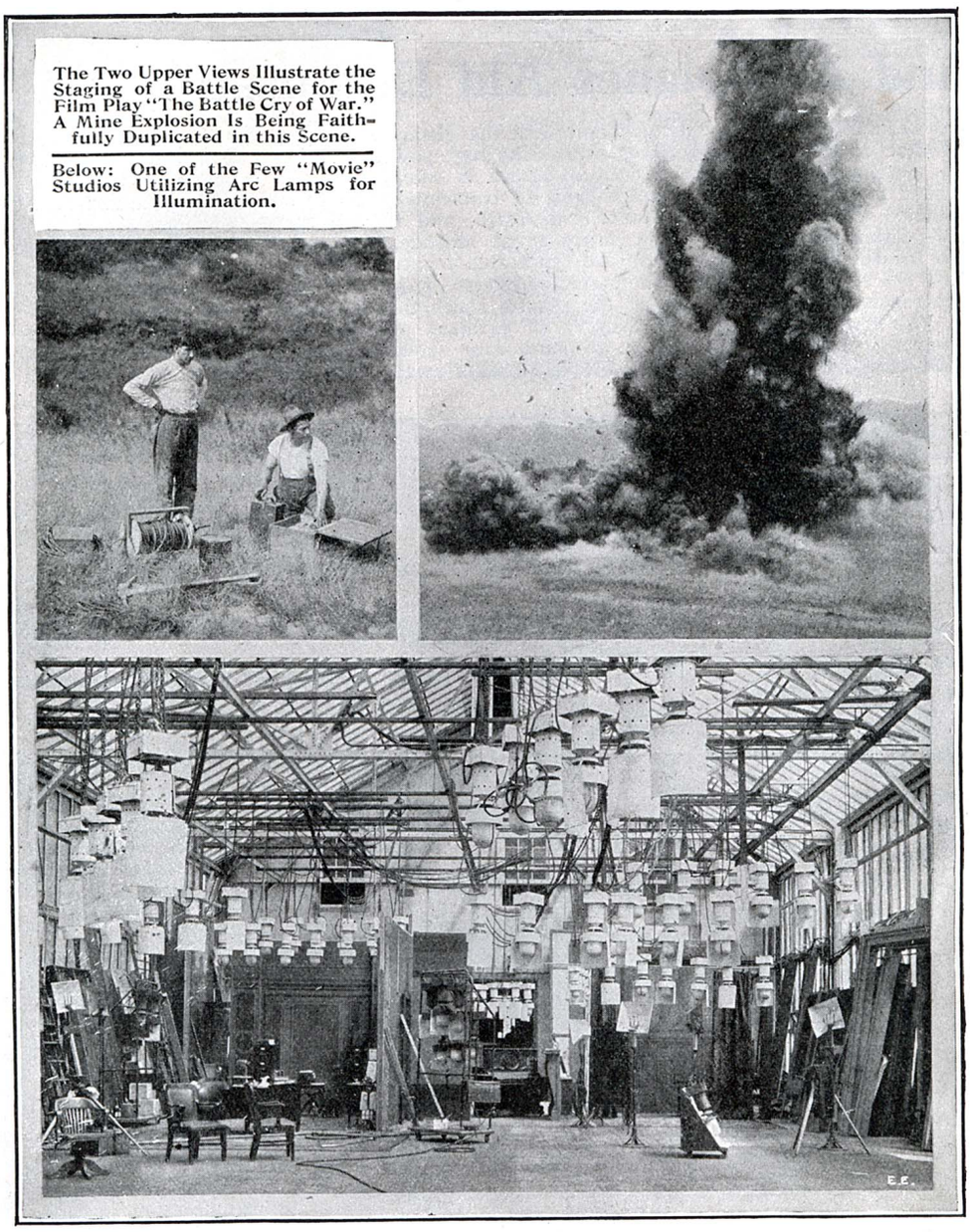
Amid a charging regiment small explosions that left shell craters three feet deep represented the shattering of shells striking the ground. In connection with these discharges bombs were simultaneously thrown into the air with a rapidity invisible to the eye, exploding about 200 feet above ground simulating shrapnel explosions. Then, here and there, heavier eruptions of earth gave the effect of mines. French mortars hurling bombs were also imitated cleverly, while rolling clouds of gas from nozzles in the defensive works gave a representation of the *real* thing in that line Here and there were mammoth 16-inch guns destroyed by internal explosions in a manner to suggest that an enemy shell had struck them fairly.

Another thing in which the indispensable electric detonating apparatus figured was the discharge of a battery of four regulation U.S. Army field guns, exactly timed to suit the psychological requirements of producer Blackton. These were not discharged by the artillerymen that stood around the guns. In this case the artillerymen merely went through the motions. A cool and practiced man in the background fired them with his trusty battery through wires connected to each gun. This was done in order that the action of the guns would be absolutely timed with the action of the scene, and for that it was necessary that one man only have control of all the discharges. This was executed delicately and in perfect harmony with the plan of the producer, with varying pauses between each flash—One-Three-Four-Two, by gun numbers.

A remarkable use of arc light illumination is that employed in the production of motion pictures at the Vitagraph studio in Brooklyn. In one of its glass-covered studios alone they employ 125 arc lights, all so arranged as to give maximum results photographically.

The matter for most comment in this application of arc lights is the fact that they are used alone and without any mercury tube lights as an adjunct. After long experimentation the company has found the best way to use these lights without employing the mercury vapor tube lamps. The studio experts utilize normal daylight as the blending medium. The satisfactory results from arcs can also be credited to an exclusive improvement in mounting the arcs, devised at this studio. The globe supports are such that no shadow is thrown by the supports upon the field to be photographed.

Another improvement incorporated in these lamps is the attachment of the rheostats directly to the lamps. In studio work this is an item of great convenience, since ordinarily the rheostats are separate from the lamps and installed on the walls wherein a maximum of wiring is involved to serve the outfit. About one hundred of these arcs are hung overhead in the studio on ten tracks, spaced ten feet apart. They can be moved about and concentrated easily anywhere, rheostats and all. The remainder of the arcs are disposed of in the form of twin-arc floor lamps on portable stands for *spots* and *ray* effects, or in the form of banks of six single arc lamps mounted on frames that may be rolled from place to place to serve as side lights. The floor lamps and the banks are fed with flexible insulated cables, and since they carry their own rheostats, are permissible for use at other locations where interior light for photography is required.



The Two Upper Views Illustrate the Staging of a Battle Scene for the Film Play "The Battle Cry of War." A Mine Explosion Is Being Faithfully Duplicated in this Scene.

Below: One of the Few "Movie" Studios Utilizing Arc Lamps for Illumination.

RHOTANIUM—NEW SUBSTITUTE FOR PLATINUM.

One of the latest scientific products of Yankee genius is an alloy known as *Rhotanium,* intended to substitute platinum. This composition is made up of several rare metals including polonium. Its specific gravity is about one half that of platinum and its cost is 50% less than platinum. The electrical resistance of Rhotanium is thirteen times the resistance of platinum, while the coefficient of resistance for changes in temperature is only one-third that of platinum. Due to the relative low cost of this new alloy it holds particular promise for use in the manufacture of crucibles and other chemist's ware for use in the chemical laboratory. It is expected to prove very desirable for use as a resistance element in small electrical furnaces such as those used in laboratories, etc.

JAMES CLERK MAXWELL.
November Marks His 37th Death Anniversary.

Born, June 13, 1831. Died, Nov. 5, 1879.

James Clerk Maxwell was born at Edinboro, Scotland, June 13, 1831. His parents, who were distinguished and well-to-do, were amply able to afford him every worldly advantage.

His chief characteristic, as a boy, was that he showed the most lively curiosity in almost everything that came to his notice. His bent was for securing accurate knowledge, and when any indefinite reply was given him, he would at once come back with, "But what's the particular go of it?" He was also a clever and industrious amateur experimenter, putting his questions directly to nature.

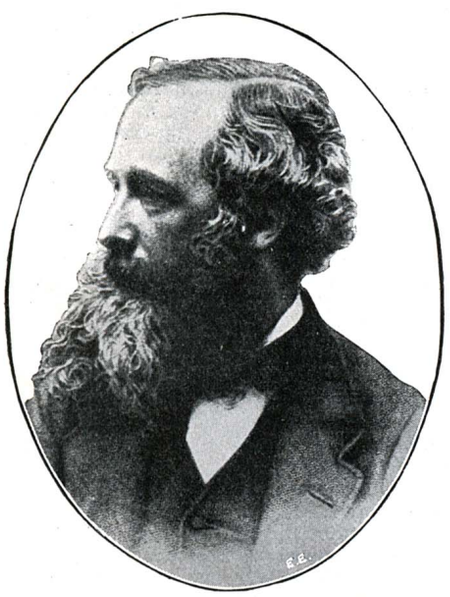
Studious and well-trained in the fine schools of the Scottish capital, young Maxwell early showed his proficiency in mathematics, making his first original contribution to that science at fifteen; for, in 1846, while he was still at the Edinboro Academy, the principal, Professor Forbes, read a paper before the Royal Society on *A Mechanical Method of Tracing Oval Curves,* written by his youthful pupil.

Shortly afterwards he entered the university, where he became an excellent student in mathematics and physical science. During this period he contributed several valuable papers. He graduated at the age of nineteen.

As he was fond of science, he entered the Trinity College, Cambridge, where he took his doctor's degree in 1854. The following year he started on a series of electrical and magnetic studies, which became the leading work of his life.

Maxwell's great work in electrical and magnetic philosophy consisted in gathering the vast store of experimental facts and observation on these subjects that had been accumulating so rapidly during the past hundred years, and weaving them into a workable theory, mathematically demonstrable, by means of which much of the observed phenomena could be explained and the relation between them better understood.

In this way he was able to go far beyond the experimenters' past performances, for he was able to make predictions based on his *theory* and its consequences—that certain things, when improved, would be found in nature to be so. Since then many of his predictions have been experimentally verified, while the developments of later years have profoundly changed our ideas on some of the subjects Maxwell treated upon.



James Clerk Maxwell, the Famous Scotch Physicist, upon Whose Mathematical Presumptions Hertz and Others Have Built the Radio Telegraph of To-day.

Perhaps the most famous instance of the wonderful insight possessed by this investigator is the case of invisible electro-magnetic waves. It was Maxwell who first demonstrated that these effects travel through space in the form of transverse vibrations, similar to those of light, but of much greater wave length and at the same velocity of light. Faraday had guessed this and Hertz proved by experiment that Maxwell's conclusions were correct. The whole science of radio-telegraphy and telephony has sprung from these basic and far-reaching facts. His grand conception was *that it is possible to account for all electric and magnetic action by supposing electricity and magnetism to be stresses and motions in a weightless material substance, called the ether.* As a consequence of this he showed that the ratio of the two centimeter-gram-second systems of electrostatic and electromagnetic units are numerically equal to the velocity of light in free space, expressed in centimeters per second, i.e., 30,000,000,000 cms., or 186,000 miles per second.

This achievement has well been called "the first great step towards the true understanding of the nature of electricity and magnetism."

All his activity of the first order took place in the compass of a short life. He

(*Continued on page 537*)

Electricity in the Treatment of Infantile Paralysis

The plague of infantile paralysis wellnigh succeeded in thoroughly alarming the entire country during the past summer. Hundreds of new cases sprung up overnight, as it were, and it seems to be the consensus of expert opinion that once the germs have started in their deadly work very little can be done towards alleviating the suffering of the unfortunate victim.

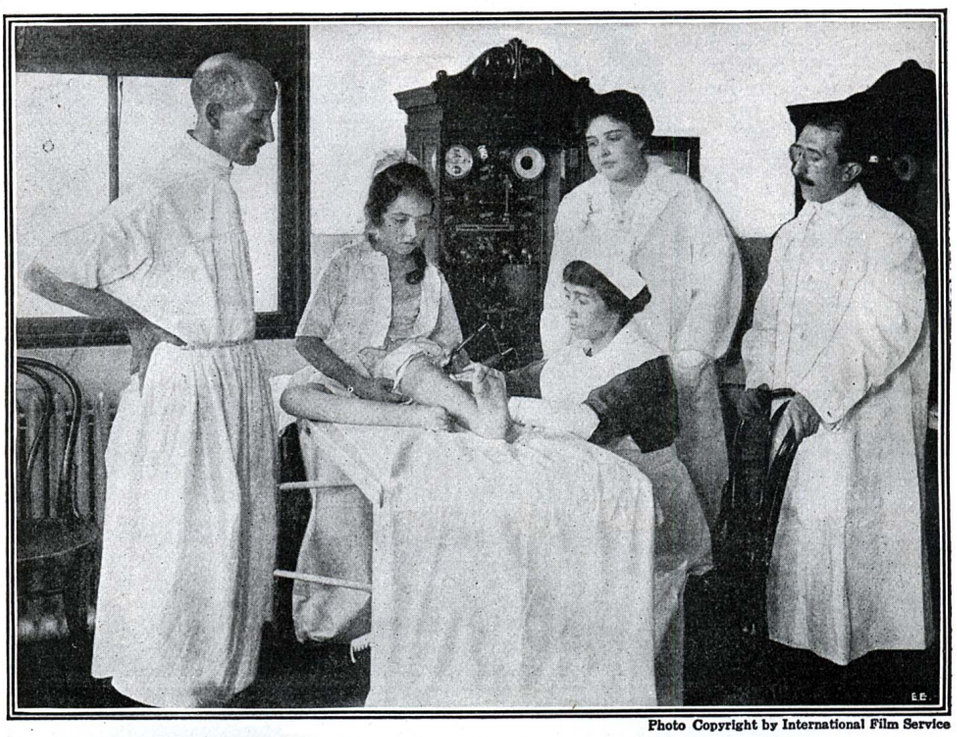


Photo Copyright by International Film Service

Electricity Has Helped to Alleviate the Suffering of the Thousands of Children Stricken with "Infantile Paralysis" and Here We See a Little Miss Receiving Such Treatment.

Some measure of success has been effected by spinal injections of blood taken from persons who have previously had the disease. However, there has to be a vast amount of muscular manipulation administered to those afflicted with the disease, and a great deal of good has been undeniably accomplished by this method of treatment.

Artificial stimulation of the muscles and nerves has been carried out in a number of instances at some of the leading hospitals by means of electric currents of the proper kind. The photograph shown herewith illustrates how electric current is applied to a child suffering from the infantile paralysis, the current being here applied through two dampened sponge electrodes. Various strengths of Galvanic, Faradic and sinusoidal currents are available from the elaborate switchboards shown in the background. These switchboards contain the necessary electrical measuring and controlling apparatus, so that the physicians and nurses can at once obtain any certain form of current.

Besides the direct application of electric currents of certain wave form and voltage for the relief of muscular paralysis, there are also available a number of special devices. There are motor-driven manipulating machines to which the patient's feet are strapped, and while they sit in a chair in front of the machine the apparatus works the limbs back and forth. In many cases there is permanent relief from what promises to be a serious case of muscular paralysis.

Professor Finsen, of the Finsen University, has successfully demonstrated that the ultra-violet light, produced by his arc light, which is of special construction, has the effect of curing infantile paralysis. It has also been shown that, by employing sunlight which passes through cobalt glass in such a manner that it is applied directly over the point where the paralysis is most acute, good results may be obtained in many instances.

It is hoped that in the near future our American physicians will start a thorough investigation with regard to the use of ultra-violet light for the curing of this perplexing ailment so little understood at present, both with respect to its causation, germination and cure.

The Telephone Valuable in Target Practice

THE telephone is doubtless the one instrument which performs more useful things than any other electrical device. It is now used in target practice and it has been found to be the most satisfactory means ever tried for signaling in this kind of work.

In the target pits are a number of iron frames, each equipped with two movable sashes, as indicated in Fig. 1. In the sashes are placed iron buzzer boxes equipped with buzzers and terminal strips. Midway in the pit, or at about the central position of all the targets, is placed a telephone box. This box is equipped with a bell that can be operated from any of the firing lines, two jacks for plugging in hand sets, and six push buttons. The push buttons are for ringing the bells mounted in the telephone boxes that are located at different firing lines. These firing lines are usually planned at 200 to 1,000 yards from the targets; Fig. 2 shows a squad firing from the 200 yard line. At each of these firing lines there is located a substantial cast iron telephone box. Each box is fitted with a bell that is operated from the telephone station located in the pit, two jacks for connecting a composite hand set, a push button to ring a bell at the station in the pit, and a number of similar push buttons for operating the buzzers that are installed in front of each of the targets in the pit.

When a company or squad of men are on any of the firing lines for practice shooting or contesting for record marks, an officer is stationed in the rifle pit at the telephone station to communicate with the firing line. At each of the targets with its associate buzzer is stationed an attendant to answer the buzzer signals, checking the targets and registering the position of the shots fired at the target.

On the firing line the contestants for markmanship are assigned to their respective places in line with the targets they are to fire at. A man is detailed and stationed at the telephone box with a telephone handset plugged in. After firing, any one of the men may call to the man at the telephone to sash or mark targets Nos. 2, 4, 10, etc.

Militia Using the Telephone for Checking Target Scores at Augusta, Ga. 1—The Target Pits; 2—Officer and Telephone Operator at Firing Line; 3—A Closer View of the Firing Line Telephone Operator Communicating with the Target Checkers.

The man at the telephone will push the corresponding number of buttons on the target called; the man in the pit hearing the buzzer immediately pulls down the sash with target and locates the shots. As one target is pulled down the one in the other sash automatically goes up, so that one target always appears above the pit. The result of the firing is signaled to the scoring officer and the men on the firing line by holding a disc over a like position on the target that is above the pit and being shot at. This target is in turn pulled down in answer to a buzzer signal and marked as in the first case. This alternating of targets is continued with every shot and carried on at each of the other targets in the same manner.

Sometimes it happens that the marking is not properly understood, or there has been an error in the location of the shot. The range officer will then instruct the operator at the telephone to call the officer in the target pit and instruct him to have certain targets re-marked, or to have any other information that may be desired communicated over the telephone. The officer at the telephone box on the firing line gets in touch immediately with the officer in the pit, to whom he gives instructions using the hand set described. When the officer in the pit desires to talk to someone on the range he pushes the button connected to the station desired. The operator at that point answers the call and procures the person wanted or delivers the message.

In some cases where the firing lines have quite a number of targets, say fifteen or twenty, it is found difficult to call out to the man stationed at the telephone the number of the target to be signaled. When this is the case, plugs are inserted in jacks with their signal conductor running out to the man on the firing line. One of these is illustrated in Fig. 3. These men can then do their own signaling by touching the end of the conductor to an iron rod driven into the ground. This feature is shown by the cords from the telephone box to a protecting cover on the ground. When not in use these conductors are coiled up and put away with the hand set. This interesting equipment was installed for the Georgia State Militia at Augusta, Georgia, by the Western Electric Company.

Every day sees some new application of the telephone to the wants of mankind.

STATUE TO PROFESSOR JOSEPH HENRY.

A bronze statue to Professor Joseph Henry, whose name is intimately associated with the invention of the telegraph, is to be erected at Albany, N.Y., for which purpose funds are now being collected. Among the members of the honorary committee are Dr. Alexander Graham Bell, Theodore N. Vail, Thomas A. Edison, Dr. M. I. Pupin and Dr. J. J. Carty.

TELEPHONE CORDS TO BE WHITE.

The shortage of dyes, due to the European war, has been felt in practically all American industries. And now it is beginning to seriously affect the telephone business.

The pair of jumper wires used on the main frame formerly consisted of one white and one red cord. But in future they will consist of one white cord and another white one with a couple of red threads woven through it.

UNION OF GERMAN TECHNICAL ASSOCIATION.

A "Verband" of the principal German technical associations has been formed under the name of the Association of German Scientific Societies. Those societies comprising the "Verband" are the Institution of German Electrical Engineers, the Institution of German Engineers, the Institution of German Architects, the Association of Blast Furnacemen, the German Chemical Society, and the Association of Shipbuilding Engineers. Headquarters are in Berlin. The "Verband" will thus represent 60,000 members of the different professions involved. One of the principal results which is looked for from the combination is the furtherance of the work of finding substitutes for the raw material hitherto obtained in neutral countries or those with whom Germany is now at war. What a fine chance for a "successful" alchemist, who could turn lead into copper, and silver into gold.

New Electric Devices Help the Housewife

POSSIBLY the latest attempt to retain the labor-saving advantages of electric cooking on a large scale, and at the same time to reduce its cost, may be seen in the combination gas-electric range. This interesting novelty is equipped with a "fireless-electric" oven while gas is retained for the burners at the top of the stove. It is too soon to speak authoritatively of the merits of this device. Certainly, however, it promises well.

The electric range has come to stay. When properly used they not only represent the acme of flexibility and cleanliness but economy as well. Some of the ranges are equipped with automatic time-switches which cut off the current at the end of any desired prearranged time. In this way the mistress or cook may start a roast on the electric range and, having set the time-switch for the proper time period, she may go out and do her shopping. The roast will be done to a turn when she returns.

Also it is possible to set the thermostat to constantly maintain the proper temperature. Baking, roasting and boiling can be done in this way. When the proper temperature is reached, which requires ten minutes to half an hour, depending upon the temperature required, the current automatically cuts off and from then on cooking proceeds as in a fireless cooker. The heavy heat insulation about the walls of the oven—two inches of rock wool—causes the ovens to retain their heat for hours. No attention is required until the hour arrives at which it was determined the meal should be ready.

With the new electric range, breakfast can be prepared in the way just mentioned the night before with the assurance that it will be ready exactly on time.

Cooking processes that do not require much time and for which the food can be prepared in advance are performed on the stove top. For this purpose the electric range has two 8-inch and one 10-inch radiant heaters, each with a special three-heat indicating control switch. In the combination gas and electric ranges, the stove top is provided with four gas burners, one of which is of extra large size with a small, specially controlled simmering burner in the center. All the burners can be lighted instantly by means of an automatic gas lighter controlled by a valve at the front of the stove, which normally burns a very small pilot flame.

It is claimed that better cooking results can be obtained in the electric ovens than in a gas oven, owing to the fact that two heaters are provided, one at the top and the other at the bottom with baffle plates to provide a uniform distribution of heat. Pastry can be browned just as in any other kind of range. It is also claimed that food shrinks less in these electric ovens than in a gas oven, owing to the more flexible application of the heat and the fact that the oven is entirely enclosed except for a small ventilating pipe.

The portable electric serving table mounted on wheels has come into vogue of late. One of these is shown herewith. They may contain several necessary devices such as an electrically heated chafing dish, a coffee percolator, tea-pot, a dish warmer, a stew-pan, etc. A flexible attachment cord enables the hostess to connect the serving table to a convenient base or floor plug receptacle.

Then, too, the up-to-date electric housekeeper can invoke the aid of the genie, Electricity, to whip the cream, shave the ice, mix the cake or bread dough, sift the flour, beat the eggs, chop meat, slice potatoes or fruit, polish the silver, wash the dishes, et cetera. Just snap the switch and—Presto—the magic current starts to work. Unlike the human servant, it never becomes tired. It is satisfaction itself.

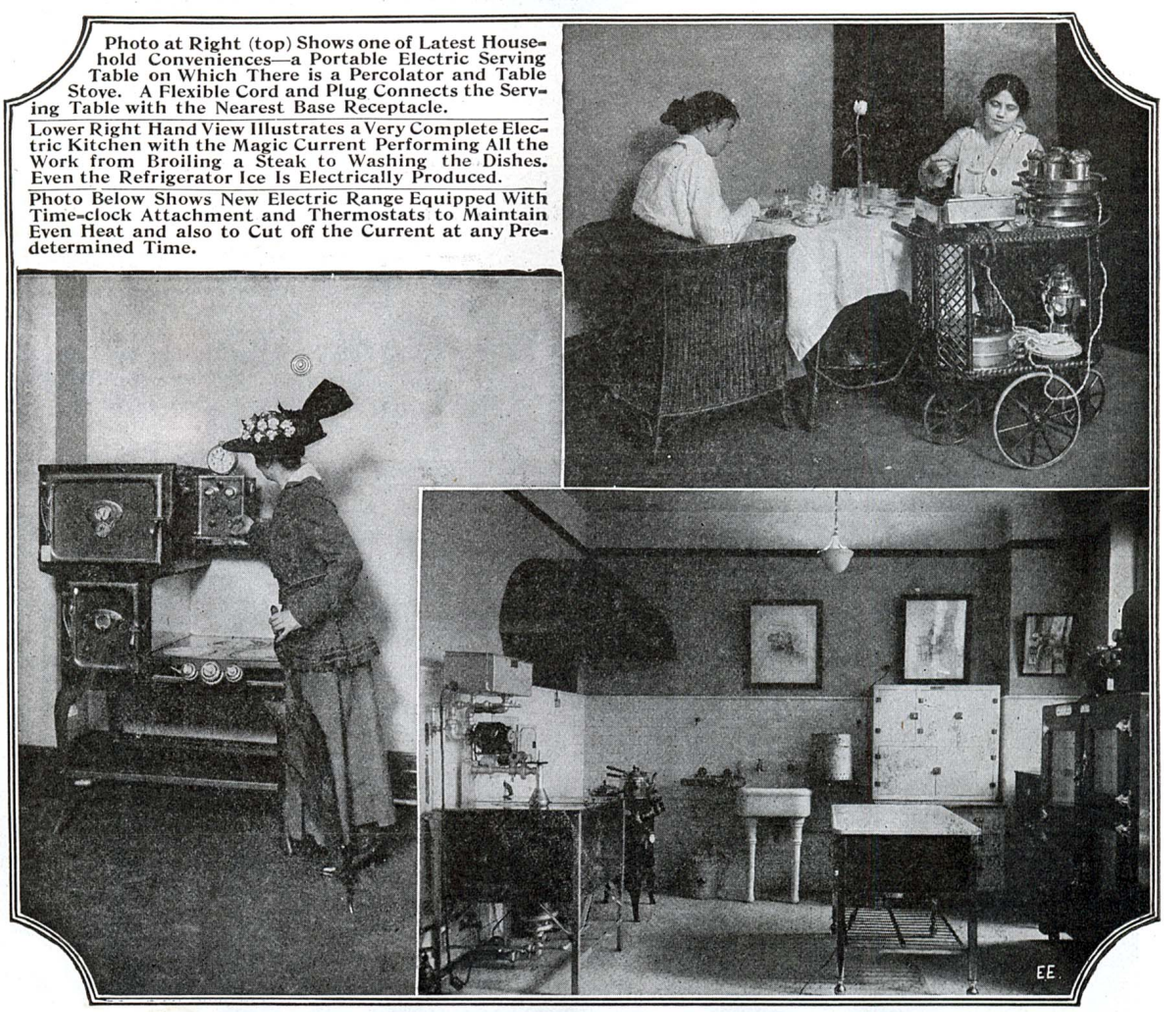
Of electric refrigeration for household purposes, one can now say that it is a fact. Machines to accomplish this work are now being produced, and it is said that the manufacturers are still busy supplying the advance orders for their machine. Like other electric power devices, the arguments for it include cleanliness, convenience and low operating cost. As a medium of refrigeration it possesses two special advantages, the extremely small temperature variation, impossible to secure with melting ice, and the fact that the machine also produces ample ice for table use, about twenty pounds in the course of twenty-four hours.

Indeed the modern housewife is faced with an embarrassment of riches where electric appliances are concerned, and one great difficulty lies in deciding where to begin. The best plan is for the prospective purchaser to study her own situation and discover where its weakest spot lies. Undoubtedly she will find some machine designed to overcome that particular difficulty. And that is the point at which she should begin the electrification of her housekeeping. *Photos courtesy New York Edison Company.*

Photo at Right (top) Shows one of Latest Household Conveniences—a Portable Electric Serving Table on Which There is a Percolator and Table Stove. A Flexible Cord and Plug Connects the Serving Table with the Nearest Base Receptacle.

Lower Right Hand View Illustrates a Very Complete Electric Kitchen with the Magic Current Performing All the Work from Broiling a Steak to Washing the Dishes. Even the Refrigerator Ice Is Electrically Produced.

Photo Below Shows New Electric Range Equipped With Time-clock Attachment and Thermostats to Maintain Even Heat and also to Cut off the Current at any Predetermined Time.



WIRELESS FROM GIRL IN CALIFORNIA HEARD IN LYNN, MASS.

The message, "Hello, Massachusetts; how are you?" vibrating its way across the country from San Raphael, Cal., was picked up by Gustave A. F. Werner with his wireless receiver in the Highland first station, Lynn, recently.

The message was sent by Miss Kathleen G. Parkin, fifteen years old, one of the youngest girl wireless operators in the country. She signed the query and added her address.

Werner immediately replied, "First rate, thank you."

She is a member of the American Radio Relay League, to which organization Werner also belongs. Miss Parkin and her work were described in the last issue of this journal.

An electric apparatus for washing smoke has been perfected to relieve cities of the smoke nuisance. The smoke is driven by fans through a column of water which washes out the soot and cinders. Pittsburgh papers please copy!

Lightning Made to Order

By Samuel Cohen

ONE of the most perplexing problems that scientists have attacked during recent years involved either the harnessing or imitation of the forces of Nature. Many of our greatest scientists in all parts of the globe have spent fabulous sums and years of patient study on such problems, but most of them have signally failed; a number of eminent scientists even claim that such conundrums will never be thoroughly solved.

This, however, appears, in our present day, to be highly doubtful. As early as 1890 Dr. Nikola Tesla undertook to solve the problem, and some years later succeeded in demonstrating to the world that it is quite possible to imitate certain natural dynamic forces on a scale of surprisingly vast magnitude.

Most of us know that *Lightning* is a natural electrical discharge taking place between two adjacent clouds, each having been charged with electricity of opposite polarity. As soon as they approach sufficiently close, the electric potential between them becomes so terrific that the air strata between is ruptured, thus producing a vivid spark, followed by thunder, which is caused by the sudden rush of air into the evacuated space produced by the electric discharge. Lightning may be caused also by a discharge taking place between a cloud and the earth. The process by which the clouds are electrically charged is still a mystery, and we must wait until some future genius will explain to us the exact phenomena that takes place in the upper atmosphere, where such electrical disturbances take place.

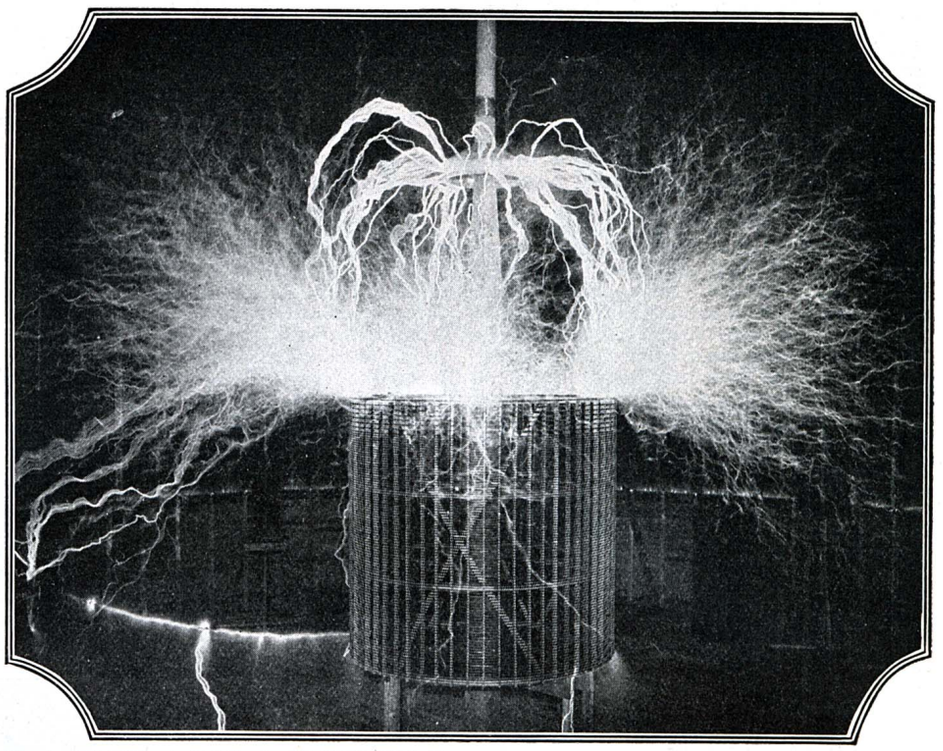


Fig. 1. The Wonderful Tesla, 300 K.W. High-Frequency Oscillator Coil in Full Activity, Discharging Sparks Like Veritable Bolts of Thor and Measuring 65 Feet Across.

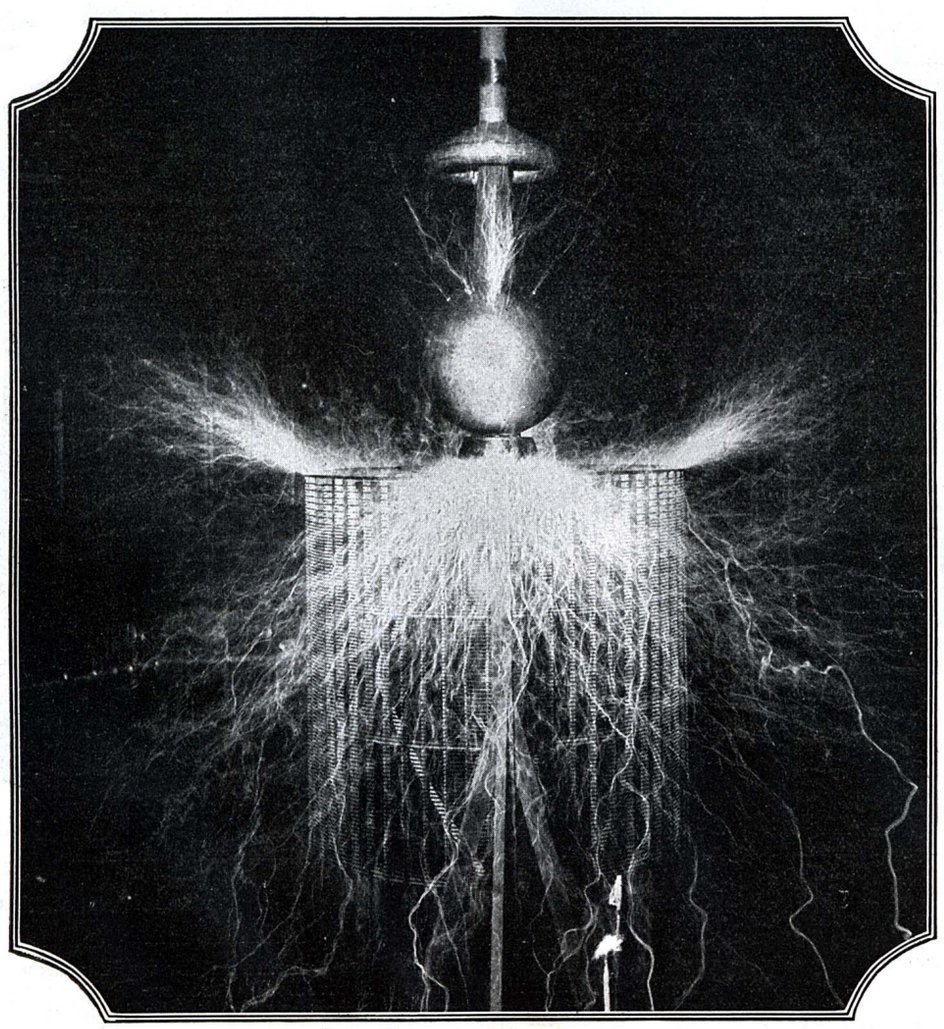


Fig. 2. A Close View of the Tesla Coil and Massive Metal Ball Which Acts as a Reservoir for the Electric Charges.

Dr. Nikola Tesla, who is perhaps the greatest living authority on alternating currents of both high and low frequency, has performed some of the most marvelous experiments ever dreamed of with high potential, high frequency currents. As early as 1890 this savant had produced electrical disturbances in his laboratory at Colorado Springs equal to the lightning produced by Nature. Although a number of years have elapsed since these experiments were conducted, not a single scientist or engineer has been able to produce such awe-inspiring, electrical performances as did Dr. Tesla. It is true that he is far ahead of his time in many of his inventions, yet he has ably demonstrated that it is possible to imitate some of Nature's secret forces. It should be noted that his sole purpose was not simply to imitate these forces, but he was performing certain experiments on the problem of radio transmission of electrical energy through space. The startling *lightning* effects here shown were produced during the course of these experiments.

During a recent interview the writer had with Dr. Tesla, the photographs herewith reproduced were kindly loaned to accompany this article. Two of these photos were never shown to the public before. Our front cover, painted by Mr. George Wall, is an exact reproduction in colors corresponding to Fig. 1. The man was seated near the apparatus solely for the purpose of showing the relative size of the high frequency oscillation coil. The photograph was obtained by double exposure; that is, the plate was exposed with the man, while the apparatus was not in operation; then he was removed and another exposure made of the sparks on the same plate, as it would not be very healthy for anyone to be there when the experiment is conducted.

In Fig. 1 we see the Tesla electric oscillator in full activity at twelve million

(*Continued on page 533*)

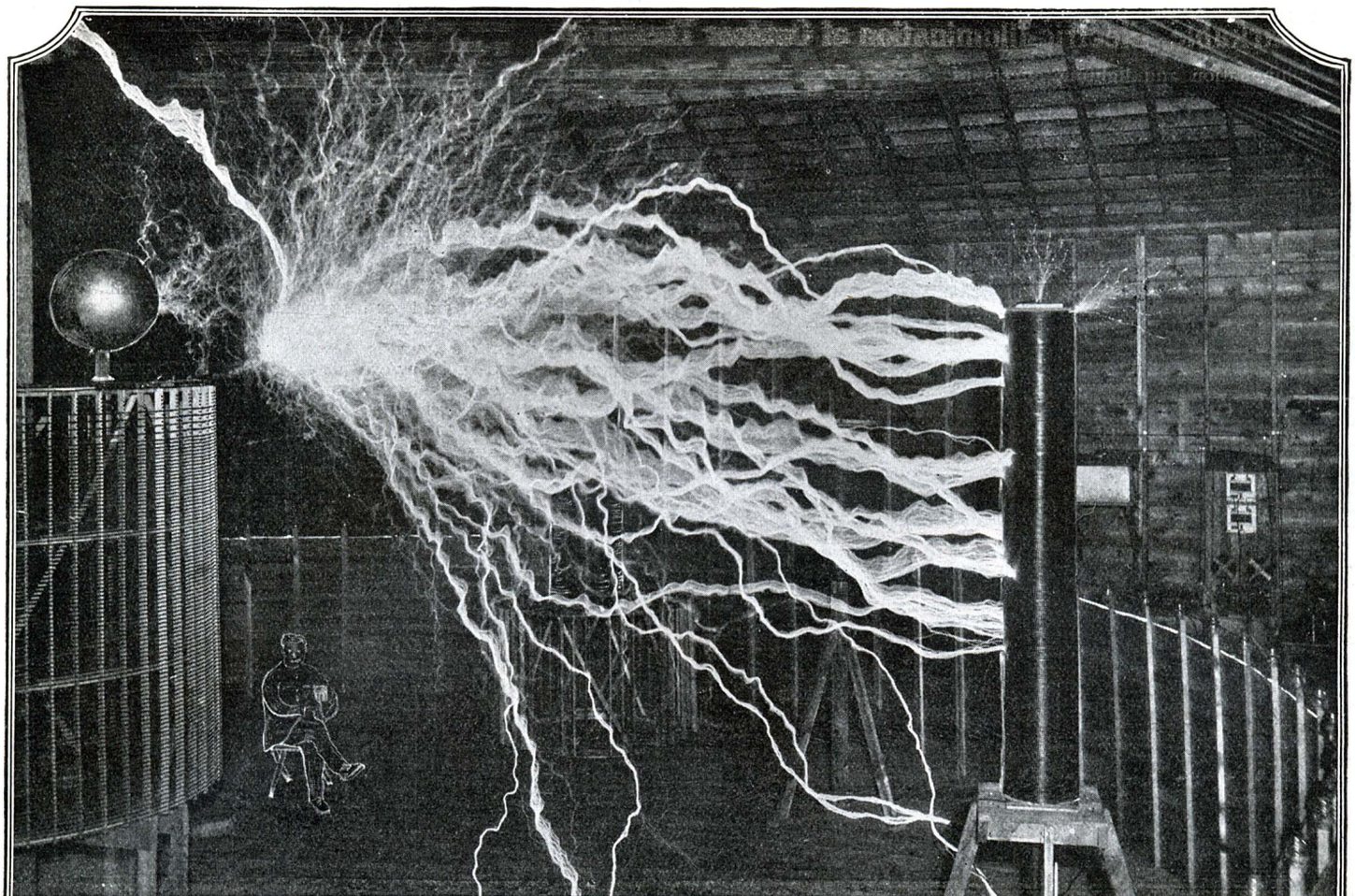


Fig. 3. Compare the Size of the Tesla Coils Here Shown with That of the Man at the Left. A Double Exposure Was Necessary —First with the Man and Apparatus, Then with the Apparatus (Less the Man) Fully Excited. Sparks Measure 22 Feet in Length.

Fig. 4. A Problem in Harmonics. Dr. Tesla Placed a Number of Inductance (Air Core) Coils Within the Large High Frequency Coil as Shown. Each Coil Resonated or Became Attuned to a Certain Harmonic of the Fundamental Oscillation. Glowing as Seen.

Remarkable Electric Illumination of Outdoor Theatrical

The illumination and lighting effects of the mammoth outdoor pageant *Caliban,* a Shakespearean Masque, recently produced in the stadium of the College of the City of New York, were remarkable in being the most elaborate system of lighting ever witnessed in a dramatic performance in America. It marks special interest in the replacing and proof of superiority of the high power nitrogen-filled incandescent lamp projector over the arc lamp.

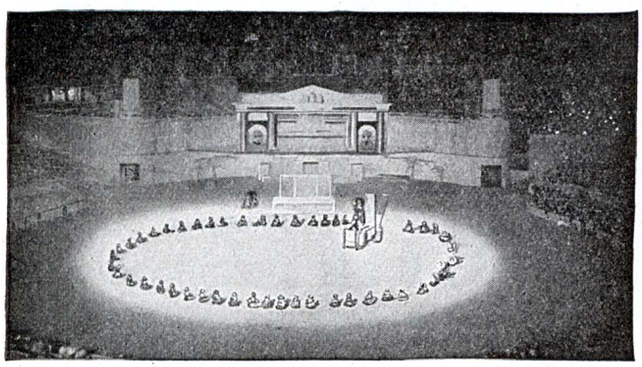


Fig. 1. Flood Illumination of the Huge Central Ring at Mammoth Outdoor Theatrical. The Distance from the Nearest Flood Light Projector to Center of the Ring Was Over 200 Feet.

The magnitude of the lighting problem is appreciated when the immense outdoor areas to be flooded from great distances is considered. The circular stadium has a seating capacity of 20,000. The immense stage shown in Fig. 1, is 80 feet long, 40 feet high and 20 feet deep, and at a distance of over 300 feet from the spot and searchlight tower. At the height of the illumination incandescent lamps and projectors drew 1,100 amperes from the alternating current lines, while searchlights and arc-lamp spot lights drew 30 amperes from the direct current power station of the City College.

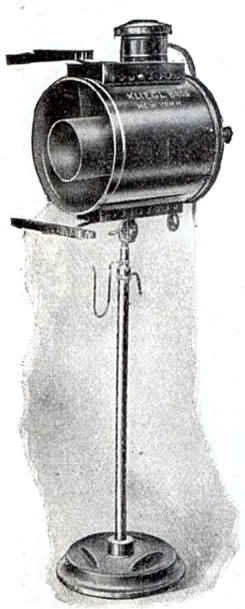


Fig. 2. One of the Daylight Flood Reflectors, Fitted with 1000 Watt, Nitrogen Filled, Incandescent Lamp, Focusing Device and Boomerang or Colored Slide Holder.

The action passed through three stages. In the large 100-foot diameter ring in the center of the stadium, 1,500 trained amateur actors and athletes presented, in action, ritual and dance, the art of the theater in Egypt, Greece, Rome, France, Germany, Spain and Elizabethan England. Directly in front of the stage proper was a large, dragon-like form of cave, around which much of the action centered and which was finally removed or seemingly transferred by lighting effects into a theater represented by the stage proper. The lighting consisted of general illumination during the entrance and seating of the audience. White flood lighting and vari-colored flooding of the different settings, illumination of the stage, with scenic effects, invisible illumination for the musicians located over the stage and the light screening or cutting out of the stage from the view of the audience, during the arrival.

In spite of the extremely large areas to be flooded with light, now bright sunlight, and then shading off into different colors and cutting out portions of the scene entirely, was accomplished to the wonder of the spectators.

All the illumination and lighting effects being produced by incandescent nitrogen-filled lamps, the lighting was controlled from a single switchboard back of the stage, the stage manager communicating his orders to the distant light operators and ordering color changes by means of an elaborate telephone system. So perfect was the central control that the lights glowed mysteriously here and there during the performance—the color of illumination varying according to the scene.

The light for the general flood illumination came from five sources of special light towers. Fig. 2 shows one of the daylight flood reflectors, batteries of which were located on the arcade of the stadium, high above the audience, the distance from these lights to the center of the ring being something over 200 feet. These flood reflectors, especially designed for this production, contained 1,000 watt nitrogen-filled incandescent lamps with high-power reflectors and a special light shield to conceal the source of light from the audience opposite. Two banks of these lamps furnished general illumination for arrival and departure of the audience from the grounds and during the performance the full battery was used for flooding the central ring, and vari-colored effects were secured by a boomerang or quick-change color slides. A bank of these lights concealed on either side of the stage flooded the stage towers with blue light. Two 18-inch searchlights and three 50 ampere spot lights, practically the only arcs used in the production, served only for spot illumination of principal figures and individuals.

One of the newest and most novel lighting features was the curtain of light. During the arrival and seating of the audience, several 1,000-watt, glass-lined reflectors were placed before the stage settings. These reflectors directed toward the audience produced a mild blinding in the direction of the stage, thus acting as a complete screen or *curtain of light.*

Special lighting for the musicians above the stage and the chorus of 300 singers was accomplished by thirty, eight foot strips of blue lights, without interfering with the illumination of the general performance. The lighting effects and special lamps for this production were designed, installed and engineered by the Universal Electric Stage Lighting Co., of New York City.

EDISON IN BED THREE HOURS IN 15 DAYS.

Thomas A. Edison recently went on another "spree." His is a sleepless spree and the one in question was termed by members of his "insomnia squad" in the inventive wizard's laboratories, as one of the greatest he ever ventured forth on. During fifteen days Mr. Edison worked all night. The fatigue of all night labor was offset by an hour's sleep each morning after breakfast. The inventor is in his sixty-ninth year and still going strong.

THE OLDEST "HELLO" GIRL.

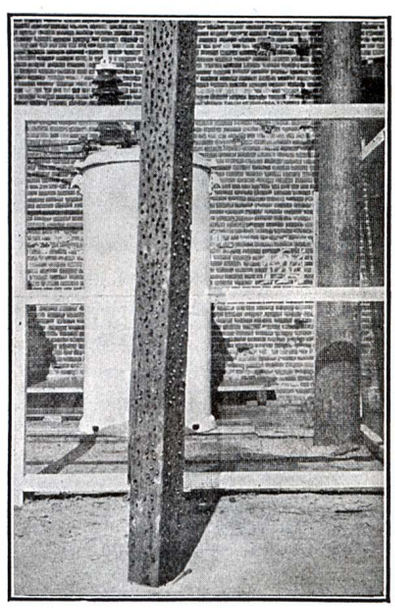
At the Linkville exchange, just outside of Kansas City, Harry Moore, aged 72 years, and his wife, Anna Moore, aged 66, plug in on the switchboard to answer calls and give connections. They give day and night service and love the work. Though Mr. and Mrs. Moore are well along in years, subscribers never have to complain about the lines being busy, for their service is always prompt and cheerful.

These operators know every man, woman and child in their community, and they know every subscriber's number. One of them is always at the switchboard. The story of these oldest operators in the world, who never receive a complaint on the service, might be read with profit by the youngest operators in the world.

Mrs. Moore knits and darns at the switchboard. Her spectacles rest on the lower ridge of her nose. Her gray hair is done up tight on her head. She is the chief operator and her husband is her worthy and faithful assistant.

WOODPECKERS ATTACK ELECTRIC LIGHT POLES.

Certain kinds of birds are fond of boring or pecking holes in trees and poles. A redwood pole on the Hanford line of the San Joaquin Light & Power Company in southern California recently had to be replaced because of the activity of the birds in using it as a storehouse for winter food.

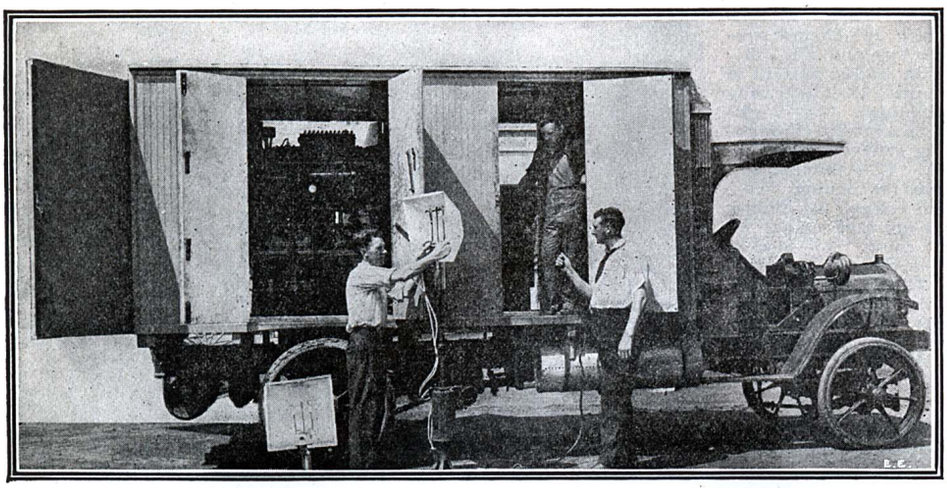


The Woodpecker Is a Busy Bird. If You Don't Think So, Just See How He Decorated This Electric Pole with His Bill.

The accompanying illustration shows a section of the pole which contained many hundreds of acorns. This particular pole had been in service seventeen years. The base had been oiled but the part above ground was untreated. It should be explained in connection with this that only poles of soft wood, which have long been exposed to the weather, are attacked in this way, and then only rarely to an extent that makes trouble for the power companies. By far the greater portion of the damage s done by woodpeckers, although several other kinds of birds, native to California, ometimes attack wooden poles. In Mexico and other countries it has become imperative that steel poles be employed, owing to the fact that worms and other pests persist in drilling holes in and through them.

Movie Concern Builds Portable Electric Plant

ONE more unit has been added to the great fleet of motor-cars in the extensive garage of the Vitagraph Company. This time it is a dynamo car to provide a portable lighting system for motion-picture photography. The car, one of huge proportions and large capacity, was built in the company's own garage from designs made by its experts. It is now in successful operation.



For Photographing Night Scenes in Isolated Districts One of the Leading Movie Producers Designed This Portable Gasoline Engine and Dynamo Plant.

Such a car has long been needed, because at many outdoor locations in the more remote sections of Long Island, where it is desired to take motion-pictures at night, there is no nearby electric line that may be tapped for current to supply the powerful arc lights. The need for facilities became more urgent after the great production of "The Battle Cry of War" was begun, sequel to "The Battle Cry of Peace."

The dynamo car consists of an enclosed van-like body mounted on a 5-ton truck, the stripped chassis of which was the foundation for the vehicle. The propulsion motor is a White gas motor bought with the chassis. In the body as built are two separate compartments. In the front one, which is the smaller, is a dynamo of 218 amperes and 120 volts rating. The rear compartment contains a five-cylinder, marine gasoline engine of 50 H.P. at the rather high speed of 750 revolutions per minute under load. The entire body is lined with galvanized iron for fire proofing and heavy rubber mats on the floor serve for electrical insulation. The body can be closed entirely to the weather.

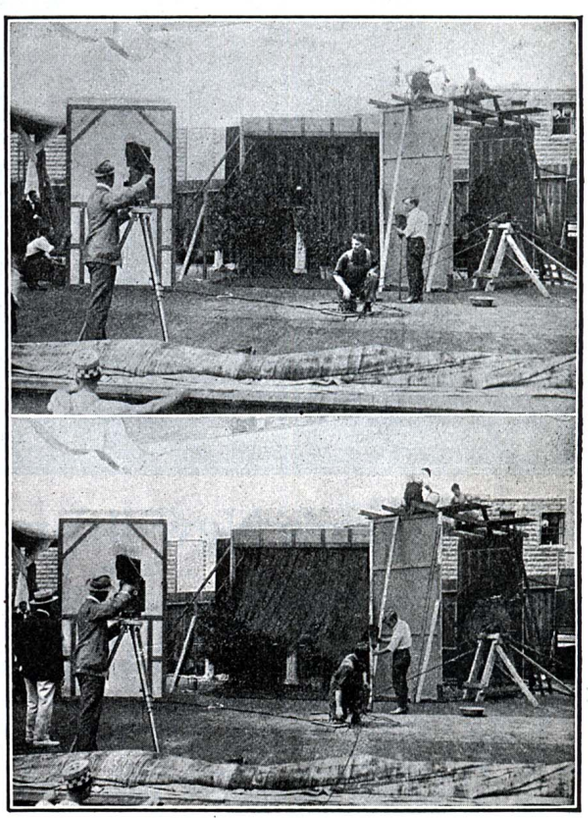
The studio arcs used for taking film action indoors are of various sizes, consuming usually about 28 amperes and 12-15 amperes. The dynamo on the car not only developed a full capacity for such lamps in the outdoor work but produced a highly satisfactory quality of light.

ELECTRICALLY MADE THUNDERSTORMS FOR THE "MOVIES."

We sit at a "movie" watching our favorite actor or actress performing all kinds of didoes, from jumping off a cliff to being electrocuted in the electric chair not thinking perhaps that electricity plays many hundred secret roles every day at the motion picture studios, from creating a beautiful tropical sun-set to an entrancing moonlight scene. It is up to the stage electrician to solve many of these problems, some of which could hardly be arranged for at all, if it were not for the great flexibility with which the electric current in its many forms, readily adapts itself to a hundred and one new problems

Fig. 1 (top) shows the stage set for a thunder-storm scene from the Thanhouser-Pathé photo-play—*Saint, Woman and Devil*—featuring Miss Florence La Badie. The rain is falling heavily as created by allowing water to fall in a thin sheet or curtain from the tank above the setting. Fig. 2 (bottom) shows the rain storm in full swing. The propeller at the right is driven by the electric motor seen at the center of the stage, and while rapidly revolving, the stage hands above the propeller empty several sprinkling cans of water on it. This results in a *driving rain* being blown against the rain curtain already falling. The actors do not get wet as they stand behind the falling sheet of aqua pura. The photos show the settings only.

An electrically ignited flash-powder charge, carefully manipulated, is passed across the scene at the proper moment, apparently shattering the large vase. The vase is sure to be shattered—never fear—for the reason that it is secured to a string held by a nearby stage attachee, who cheerfully yanks it asunder at the psychological moment.



It's Raining in the "Movies." Above We See the Pouring Rain and Below—A "Terrific" Wind, Created by an Aeroplane Propeller Which Drives the Rain Toward the Left.

TUNGSTEN PRODUCTION SETS NEW RECORD FOR THE UNITED STATES.

The tungsten production of the United States during the first six months of 1916 exceeded the production of this or any other country in any previous twelve months. Prices were even more phenomenal than production and reached more than ten times their ordinary level. The output was equivalent to about 3,290 short tons of concentrates carrying 60 per cent WO_3, valued at $9,113,000, according to an estimate made by Frank L. Hess, of the United States Geographical Survey. California is one of the chief tungsten producing states.

SILVER CAN BE MAGNETISED.

By H. J. Gray.

It was discovered in the course of some experiments conducted upon the Newtonian constant of gravitation, described in a paper read before the Royal Society in December, 1915, that silver is capable of being magnetized under certain circumstances. Bars of very pure silver were heated to 130° C. and kept in a strong magnetic field, and it was afterward found that they had become permanently, though weakly, magnetised. This curious result, which is really an offshoot of experiments directed to quite a different end, reminds us that magnetism is not a property peculiar to iron, any more than radio-activity is peculiar to radium. Iron and nickel are chief magnetic metals.

ELECTRICITY IN THE LAUNDRY.

The use of electricity in the laundry has been making steady progress, but its usual application is in driving motors and heating irons and mangles. The extension of its use for electrolysis represents one of the latest applications which promises to improve the laundering process, reduce the cost, and add to the load of the central station. There should be many opportunities for introducing this process in all cities.

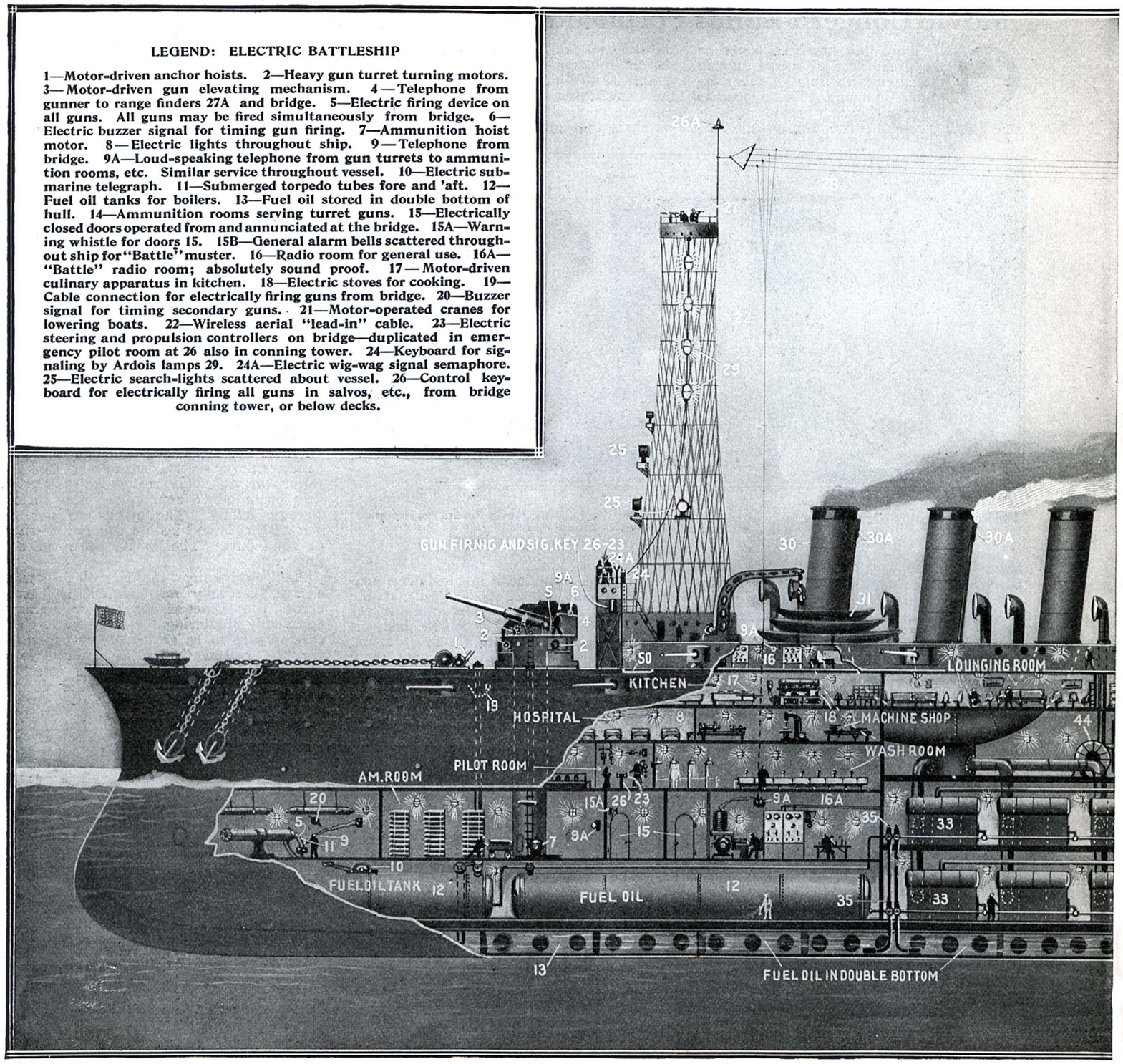
A notable application of this process on the British hospital ship *Aquitania* has recently been reported. In that case ordinary sea water is used as an electrolyte and the resulting product is applied not only in the laundry, but also in the swimming bath, for various disinfecting purposes about the ship and for surgical use. It is also applied for the purification of drinking water, one part in one million sufficing in this case. The electric sad iron has also proved to be extremely efficient.

German engineers are using zinc wires in place of copper, which is required for military purposes.

Electrically operated locks are now fitted on automobile doors. Pressing a button opens the door.

LEGEND: ELECTRIC BATTLESHIP

1—Motor-driven anchor hoists. 2—Heavy gun turret turning motors. 3—Motor-driven gun elevating mechanism. 4—Telephone from gunner to range finders 27A and bridge. 5—Electric firing device on all guns. All guns may be fired simultaneously from bridge. 6—Electric buzzer signal for timing gun firing. 7—Ammunition hoist motor. 8—Electric lights throughout ship. 9—Telephone from bridge. 9A—Loud-speaking telephone from gun turrets to ammunition rooms, etc. Similar service throughout vessel. 10—Electric submarine telegraph. 11—Submerged torpedo tubes fore and 'aft. 12—Fuel oil tanks for boilers. 13—Fuel oil stored in double bottom of hull. 14—Ammunition rooms serving turret guns. 15—Electrically closed doors operated from and annunciated at the bridge. 15A—Warning whistle for doors 15. 15B—General alarm bells scattered throughout ship for "Battle" muster. 16—Radio room for general use. 16A—"Battle" radio room; absolutely sound proof. 17—Motor-driven culinary apparatus in kitchen. 18—Electric stoves for cooking. 19—Cable connection for electrically firing guns from bridge. 20—Buzzer signal for timing secondary guns. 21—Motor-operated cranes for lowering boats. 22—Wireless aerial "lead-in" cable. 23—Electric steering and propulsion controllers on bridge—duplicated in emergency pilot room at 26 also in conning tower. 24—Keyboard for signaling by Ardois lamps 29. 24A—Electric wig-wag signal semaphore. 25—Electric search-lights scattered about vessel. 26—Control keyboard for electrically firing all guns in salvos, etc., from bridge conning tower, or below decks.



Uncle Sam's New 40-mile an Hour "Electric" Battle-Cruiser

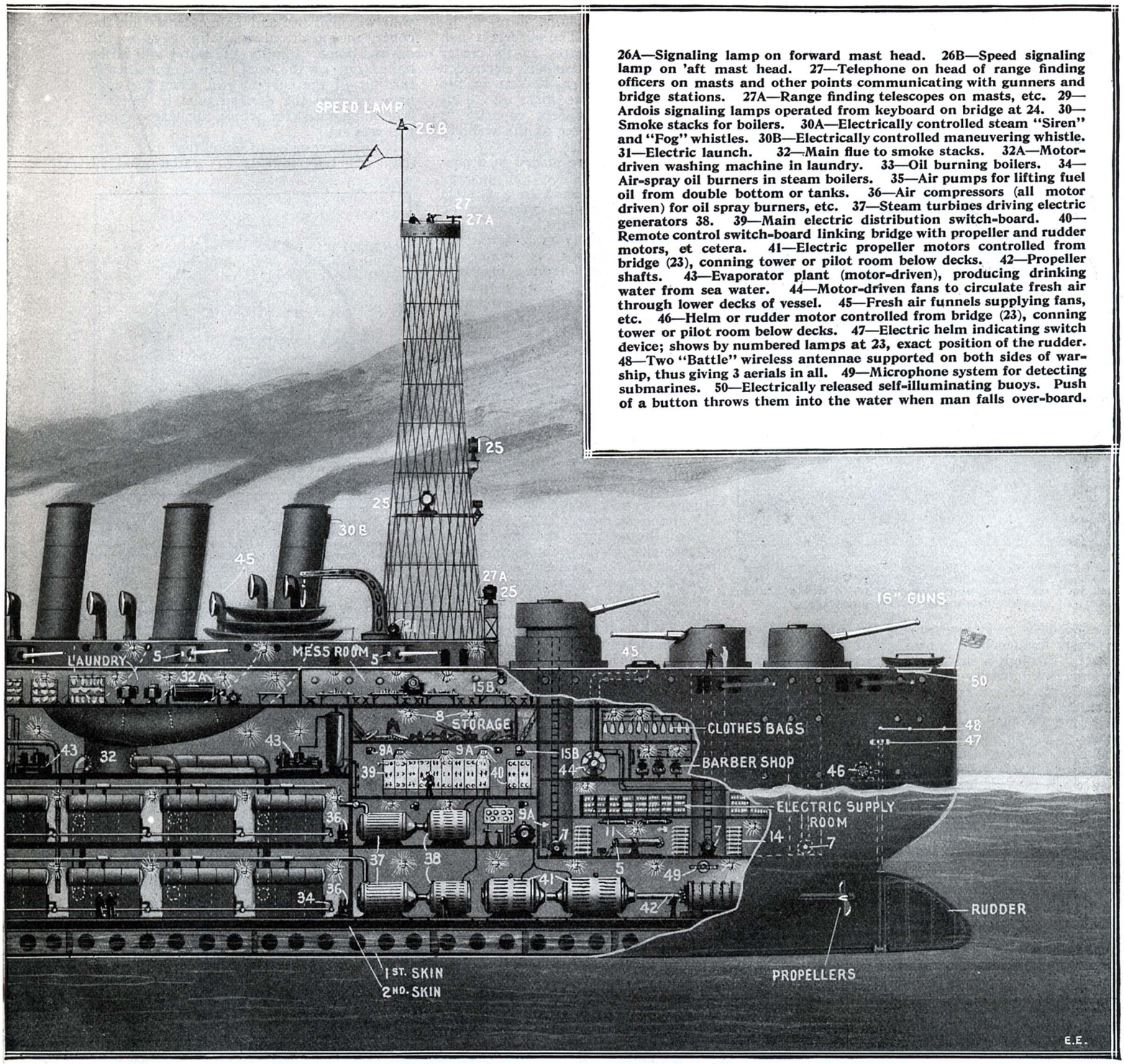
By H. Winfield Secor and Arthur C. Doyle*

The most wonderful fighting ship ever built by any nation is about to be constructed for the U. S. Navy. It will speed over the seas at over forty miles an hour. The armament will be of the best, the main battery comprising eight 16-inch guns of the highest power, besides numerous smaller calibre guns. The electric power plant driving the propellers will develop 175,000 H.P., sufficient to operate all the New York Subways.

WHILE the foreign powers are busily engaged in a titanic struggle for the supremacy of Europe, Uncle Sam's naval engineers have been also busily engaged, though in a somewhat different way. The results of their calculations and researches have brought forth plans for one of the mightiest fighting craft ever dreamed of, even by naval constructors. In short, these new ships, four of which have been authorized to be laid down next year, will resemble huge blast furnaces gone to sea. From their six massive smoke stacks there will belch forth reeling black smoke from 175,000 H.P. in boilers. These ships will be designed with special regard to the shape and finish of the hull, which will have a length of nearly 900 feet. The beam of the vessel will be 97 feet, and their full load displacement about 40,000 tons. These marvelous ships, the greatest of their kind ever designed, are scheduled to attain a speed of 35 knots with full equipment aboard. And the naval experts are in hopes that they will tear through the sea at 38 knots or more, stripped. This velocity of travel is equivalent to about 42 land miles per hour.

These latest bull-dogs of the sea will be electrically driven and their boilers will be of the oil-burning type. It has been specified that they shall be so equipped that they can steam along without giving off any smoke from their stacks, when it is desired to conceal their movements. They are to be so arranged that when desirable, for maneuvers, heavy banks of thick, black

*(*Formerly Chief Electrician U.S. Navy*).



26A—Signaling lamp on forward mast head. 26B—Speed signaling lamp on 'aft mast head. 27—Telephone on head of range finding officers on masts and other points communicating with gunners and bridge stations. 27A—Range finding telescopes on masts, etc. 29—Ardois signaling lamps operated from keyboard on bridge at 24. 30—Smoke stacks for boilers. 30A—Electrically controlled steam "Siren" and "Fog" whistles. 30B—Electrically controlled maneuvering whistle. 31—Electric launch. 32—Main flue to smoke stacks. 32A—Motor-driven washing machine in laundry. 33—Oil burning boilers. 34—Air-spray oil burners in steam boilers. 35—Air pumps for lifting fuel oil from double bottom or tanks. 36—Air compressors (all motor driven) for oil spray burners, etc. 37—Steam turbines driving electric generators 38. 39—Main electric distribution switch-board. 40—Remote control switch-board linking bridge with propeller and rudder motors, et cetera. 41—Electric propeller motors controlled from bridge (23), conning tower or pilot room below decks. 42—Propeller shafts. 43—Evaporator plant (motor-driven), producing drinking water from sea water. 44—Motor-driven fans to circulate fresh air through lower decks of vessel. 45—Fresh air funnels supplying fans, etc. 46—Helm or rudder motor controlled from bridge (23), conning tower or pilot room below decks. 47—Electric helm indicating switch device; shows by numbered lamps at 23, exact position of the rudder. 48—Two "Battle" wireless antennae supported on both sides of warship, thus giving 3 aerials in all. 49—Microphone system for detecting submarines. 50—Electrically released self-illuminating buoys. Push of a button throws them into the water when man falls over-board.

smoke can be rolled out of their stacks, forming a veritable cloud bank or screen to conceal the operations of other war vessels behind them.

The general arrangement of the electrical and other equipment upon these wonderful examples of modern naval architecture, is shown in our accompanying wash-drawing. Some idea of the vast size of the power plant, or, rather, the vast amount of energy required to be developed by the power plant, may be had by comparing it for the moment with the horse-power developed by such a central station as that supplying electric power to the City of New York. When these monster craft develop 175,000 H.P. they will then be producing 25,000 H.P. more than the grand total put out by the Fifty-ninth Street Power Station of the New York Edison Company, this station operating the whole New York Subway system.

The General Electric Company will install the turbo-electric generating equipment as well as the electric motors, which are directly connected to the propellers. The electric generating equipment will comprise 4-35,000 kilowatt turbo-generators. These gigantic dynamos, together with their driving turbines, measure 50 feet, 7 inches long by 22 feet wide and 15 feet high. They will be placed on two decks, as shown in the accompanying illustration, according to the present plans. The relatively small space thus occupied by this monster power plant becomes evident when compared to the space that would be occupied by the reciprocating steam engine, used on most of the ocean-going vessels.

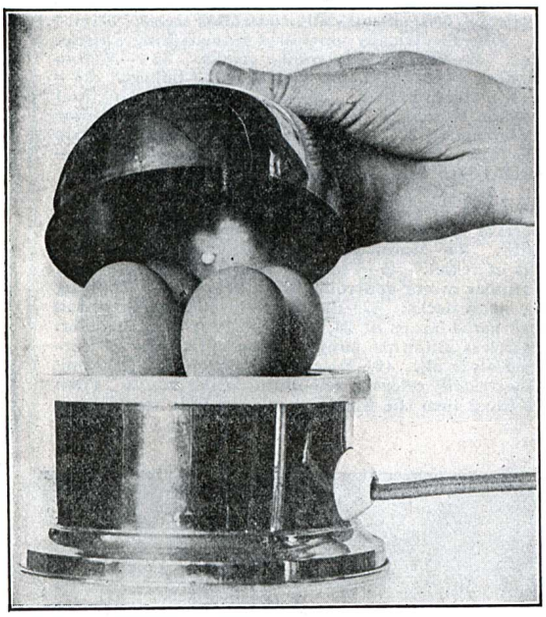
Do you know what happens on a modern fighting ship when the enemy is spotted? The multifarious rôles played by electricity in locating the enemy war-vessel, and in firing the guns, propelling and steering the ship, also many other highly interesting but generally unknown features are explained in this specially prepared and timely article.

Another important item is the fuel to be used under the boilers. This will be petroleum or other oil of similar thermal value. And besides that carried as reserve, in tanks, a large portion of the oil fuel will be stored between the two steel skins of the double bottom of the hull. The very latest type of specially designed and extremely compact water-tube boilers will be fitted with highly efficient, compressed air

(Continued on page 533)

COOKING EGGS BY ELECTROLYSIS

An ingenious electrical cooking device has recently appeared, which, among other novel features, does not make use of heat developed in resistance wires, but instead steam is formed by the passage of current directly through a small quantity of water in sufficient quantity to cause the water to boil. This device is used principally for cooking eggs, and in this connection the use of a graduated quantity of water will allow of a regulation of the degree to which the eggs are cooked, without any further watching; the circuit breaking automatically when the water has been boiled away. The cooker is so arranged that it will cook the eggs to the same extent, whether there is one egg or more and whether the eggs are large or small.



The Latest Device for "Cooking" That Great American Breakfast Essential—the Egg. The Hen-Fruit Are Steamed, Not Boiled, and This Is Said to Make Them Extremely Edible.

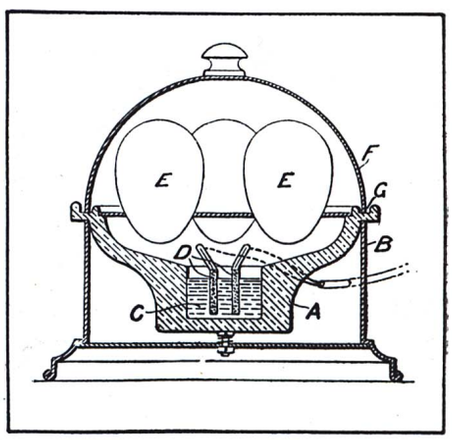
A description of this device will make these points apparent. A porcelain dish, A, is held in a nickel plated base, B, by means of a special bolt. The porcelain dish has a small well, C, located in its center and in which the two carbon electrodes D are placed. The cover, F, sets in the groove, G, of the dish, A. This groove is of sufficient capacity to hold as much water as the well, C, will hold.

The eggs, E, are placed in a perforated metal holder. A separable plug is connected to a flexible cable which leads the current to the two carbon electrodes.

The operation is as follows: A measured quantity of water is placed in the well from a measure. The measure is filled up to the desired point by covering one or more of the holes with the fingers, thus determining the degree to which the eggs will be cooked, whether soft, medium, or hard. When the current is turned on a sufficient quantity flows through the water and the carbon electrodes to cause the water to boil almost immediately. The resistance of the water is materially reduced by the carbons, which contain sufficient salts to insure satisfactory operation at all times. Salt should therefore never be added to the water.

For the uniform cooking of different size or different numbers of eggs it will be apparent first of all that the amount of steam condensed on the surface of the egg will be approximately proportional to the amount of heat absorbed by the egg. Thus, when steam first begins to form, the eggs are cold and will absorb a great deal of heat and the condensation on their surface will be great. It is obvious that a large egg with a greater surface will condense more steam than a smaller egg. Now, as the eggs are placed directly over the sloping sides of the bowl, all this condensed steam will run into the well and will be evaporated by the heating action of the electric current. On the other hand the steam which is condensed on the inside of the cover will run down into the groove G and remain there. Therefore, when the eggs have become heated to the point where condensation no longer takes place on their surface, the water in the well will boil out and be condensed on the cover, meantime, cooking the eggs to the desired point. Finally, the water will all be boiled out of the well, thus automatically turning off the current just when the eggs have reached the desired turn to suit the individual taste for which the water measure was set.

It is interesting to note that not more than 1½ teaspoonfuls of water need be boiled to cook four eggs, as compared with the kettle full that used to be necessary. The economy of this must be obvious. Furthermore, no one who has eaten eggs cooked by steam will ever want to eat the old fashioned boiled eggs again it is claimed. The whites are never tough as they are in boiled eggs, but always tender and delicious.



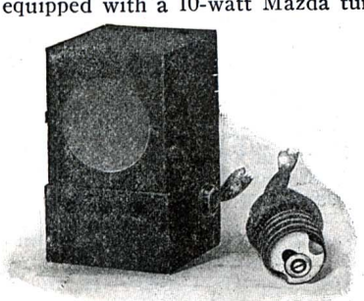
To Cook Eggs to Just the Right Degree, a Measured Quantity of Water Is Placed in the Lower Receptacle C. Ebullition Is Produced by the Electric Current Passing Thru the Water; Finally All the Water Condenses on the Cover F, and Into Groove G, Thus Cutting Off Current.

This same device when used for warming babies' milk is a household convenience that fills a long felt want. It is impossible to burn or scorch the milk and it is unnecessary to watch it while it is warming.

Other possibilities for this form of electric heater are being developed, as it is apparent that it can be applied for all sorts of steam cooking as well as warming liquids and sterilizing material by steam.

AN ELECTRIC LAMP FOR THE MICROSCOPE.

The lamp here illustrated is constructed to throw the light either on the mirror or directly up through the condenser of the microscope. It gives illumination sufficient for oil immersion work. It is small and compact yet very efficient and is neatly finished in black crystal lacquer. No light can escape except through the single opening. It is equipped with a 10-watt Mazda tungsten bulb, and works on any 110-volt circuit. It can be used on 220-volt current when placed in series with proper resistance. The microscope lamp is supplied with blue and ground, and *Daylite* glasses; the latter, when placed in front of a nitrogen-filled tungsten lamp, gives a white light having the same color and spectral energy distribution as natural daylight.



A Miniature Electric Lamp which Gives Effect of Daylight for Microscopic Requirements.

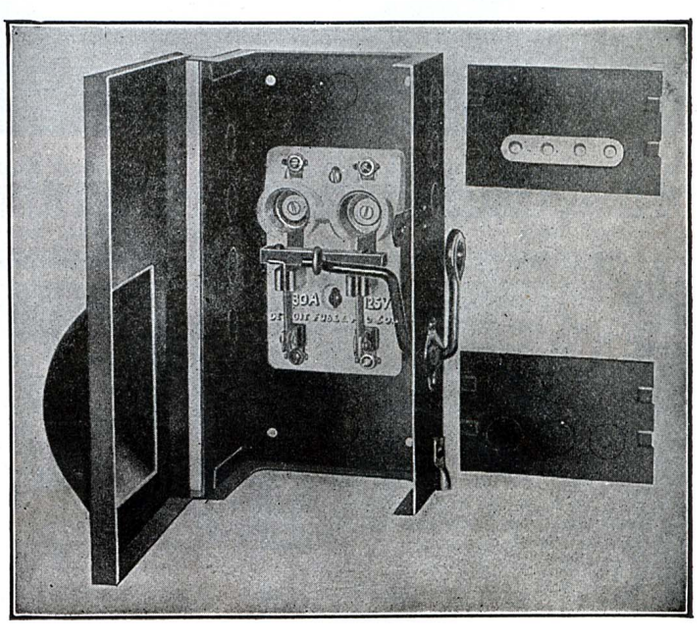
A SHOCK-PROOF SWITCH FOR "SAFETY-FIRST."

Each year the newspapers print accounts of accidents resulting from the use of the open type switch widely used in industrial plants. Often such accidents go unrecorded, but were it possible to make an accurate accounting the total would probably be surprisingly great.

The *enclosed switch* here illustrated offers a complete remedy for the open switch evil.

The switch and cut-out unit are completely enclosed in a metal box provided with a hinged cover which is held closed with a simple spring catch. The switch is operated by a crank handle located outside the box. It may also be locked in the *off* position to prevent accident when repairs are in progress. Means are also provided to lock or seal the cover shut to prevent unauthorized persons overfusing the switch or tampering with *live* connections.

Photo *Western Electric Co.*



A "Safety-first" Electric Service Switch which Can Be Locked in the "Off" Position.

Charles Proteus Steinmetz—This Month's Supplement

CHARLES PROTEUS STEINMETZ, the subject of our photographic supplement with this number of THE ELECTRICAL EXPERIMENTER, is perhaps the most widely known electrical engineer in the Western hemisphere, and his fame has spread to practically all parts of the civilized globe.

In his official capacity, Dr. Steinmetz serves as Chief Consulting Engineer of the vast General Electric Company's works in Schenectady, N.Y.

This accomplished scholar and technician, whose name is practically a household word in the United States at least, started his career in a very inauspicious manner; and yet again, some would call it a very auspicious manner.

He was born in Breslau, Germany, in 1865, and when he grew up he associated with a number of the most radical Socialists in Germany. In fact, he was placed in jail with a number of Socialists, but as nothing could be proved against him, he was released. One thing led to another however, and so it came about that he became what Americans term "an undesirable citizen," at least from a German political viewpoint. The upshot of these matters was that Dr. Steinmetz, then a young man, withdrew to Switzerland and eventually came to the United States.

It was in the year 1889 that this seemingly very ordinary young man reached New York in the steerage of a French steamship. He carried letters of high recommendation from his professors at Breslau and the Polytechnische in Zurich, but his pockets jingled not with the coin of the realm, or, at least, not above a few dollars.

He finally procured a position as draftsman, which, although opening excellent channels for his intellectual proclivities, did not prove of sufficient scope for applying the vast knowledge which he had accumulated in the subjects of mathematics, physics, chemistry and medicine.

The company with which he had become associated in the capacity of draftsman was finally absorbed by the General Electric Company, and it was not many years before Charles P. Steinmetz had made a name for himself; in fact, such a name that he was appointed head of the Consulting Engineering Department of the Company. This was but five years after he had reached America.

The name of Steinmetz is synonymous with *mathematics* to most people who know even the least bit about him, and he himself has said that he attributed all of his success and advancement to his excellent knowledge of mathematics.

He takes active interest in various phases of educational work and serves as president of the National Corporation of Schools. This association aims to give industrial training to grade-school boys in order that they may be able to gain sufficient technical educational to enable them to hold positions of responsibility with greater remuneration than that accorded to the unskilled.

Also Dr. Steinmetz has a class in electrical engineering at Union College, and this Institution gave him the degree of Doctor of Philosophy in 1903.

Some idea of the responsibilities and important work performed in the electrical field by this peer of electrical engineers may be gained from the fact that he receives the largest income ever paid to anyone in a similar capacity, which amounts to $100,000 a year.

Dr. Steinmetz is very short in stature and somewhat stooped. He is always ready to talk on any subject owing to his extremely broad education. And he still believes in Socialism—even for Americans. He is said to have but one suit and to wear no hat at all—true Socialism. His interviewers invariably find him puffing away at a long black cigar.

With his manifold duties as Chief Consulting Engineer to the mightiest electrical corporation of all time, he has found an opportunity, in his spare moments, to write a number of electrical books which have become *classics* in the science of electrical engineering. Ask any electrical engineer or electrical expert as to what books he considers the most valuable in his library and he will answer you in one word—Steinmetz!

WITH THE DECEMBER ISSUE

we will present another

SUPPLEMENT

of a famous radio inventor. This is the second of a series promised to our readers.

These supplements are printed on fine art paper, ready for framing. They are invaluable to adorn your den, your wireless station, or your laboratory.

Order your copy now, to make sure you will get it.

A FARMER PUZZLES THE TELEGRAPH EXPERTS.

Up in northern New York during last August a farmer with good intentions, but slight knowledge of the characteristics of the electric fluid, created a lot of trouble for the board attendants and quad men of the Western Union Company at New York, Syracuse, Watertown and Ogdensburg, says *Telegraph and Telephone Age*. At a point where the poles carry half a dozen or more of the principal wires that terminate at Ogdensburg, the farmer wished to pass under the wires with a load of hay, but found that his load was too high. He solved his difficulty by encircling all of the telegraph wires with a piece of his own wire used in binding bales of hay. This he drew tight, raised the obstruction and drove on, leaving his "tie wire" in place for the benefit of other farmers who might wish to pass that way with loads of hay.

This happened shortly before noon. Business between New York and Ogdensburg stopped suddenly. The wire experts soon developed the worst "cross" they had ever met with. Upon opening all but one of the circuits they could work through the remaining one after a fashion. Selection at random was as good as using the same wire at both ends, provided all the other circuits were opened.

This state of affairs lasted until the middle of the afternoon, adding gray hairs to the heads of the experts and emphasis to their remarks. Suddenly normal conditions returned. Later in the day the lineman's report cleared up the mystery.

LITERALLY.

"Here are a lot of suggestions from outsiders as to how to run this newspaper. See that they are carried out," said the editor.

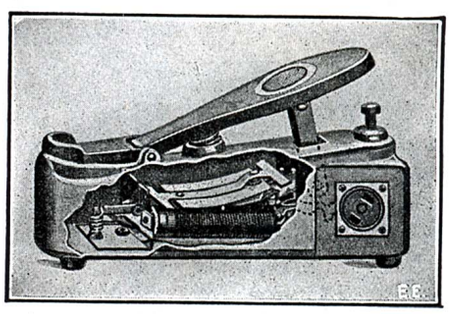
"Yes, sir," said the office-boy, and, putting them all in a waste-paper basket, he promptly carried them out.

PRESSURE OF FOOT CONTROLS THIS SEWING MACHINE MOTOR.

The women folks like handy devices, especially electric devices—but above all else, they must be simple and efficient. This applies particularly to electric drives for sewing machines; a large variety of speeds are very desirable for such work, but the ordinary rheostat used for controlling the motor current gives only a few variations in speed at best.

The Harder You Press on this Foot Rheostat the Faster the Motor Runs.

In a recent sewing machine controller put on the market there is inserted in the circuit a coil of wire with about 120 turns of such high resistance as to block the circuit completely. This coil is placed inside a neat metal treadle-box, with a slightly curved strip of phosphor bronze above it and just under the treadle. The coil is well insulated by a special cement, except directly beneath this strip. As the operator presses her foot upon the treadle, the strip of phosphor bronze is pushed down upon the resistance coil. On account of its curved contour, it does not, under a moderate pressure, come in contact with all the coils. Those with which it does make contact, however, are short circuited, thus reducing the resistance of the entire unit and permitting the passage of some current. The harder the operator presses upon the treadle, the more the strip is flattened out and brought into contact with the coil. The more of the coil is short-circuited, the more current is allowed to pass.



Detail View of Foot-controlled Motor Rheostat which Operates Sparklessly.

With increased current, the motor, and with it the machine, runs faster. Therefore the operator has, theoretically, 120 different speeds at her disposal and the harder the foot pressure is the faster the machine will run.

NEW ELECTRICAL METHOD OF CLEANING SILVER—A HELP TO MOTHER.

Most of us have seen our women folk endeavoring to scour or polish silverware, particularly the discolored knives and forks,

Cleaning Silverware Is no Longer a Detestable and Aggravating Task, Thanks to the Electrical Method of Cleaning it Here Described.

by any one of several well-known first-hand methods involving the use of ashes, pastes or compounds variously guaranteed to shine anything, even down to lead. And most of us know what an unpleasant and thankless task this is to everyone whose lot it is to perform it.

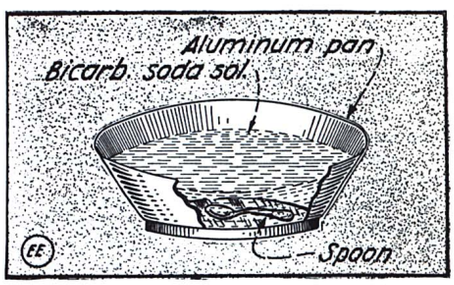
Instead of scouring the knives and forks and taking the chance of marring the finish of the silverware, there is now an electrolytic method of quickly and efficiently cleaning such silverware, no matter how soiled or discolored it may be.

The illustration herewith shows the simple "apparatus" required to carry out this process. It is necessary to purchase a small aluminum pan about eight or ten inches in diameter, which may be of any shape. Be sure that the vessel is of aluminum. A sufficient quantity of bi-carbonate of soda, costing less than ten cents a pound, is then placed in the pan with boiling water to give a saturated solution. This is placed on the kitchen stove, so as to be kept thoroughly hot while the discolored silverware is immersed in the solution and allowed to rest on the bottom of the pan. It should be noted that the various silver pieces must not touch each other, but they must invariably touch the aluminum vessel.

An electrolytic action is set up so that current passes between the aluminum container and the silver pieces, and the latter, being positive to the aluminum, causes in consequence an extremely slight amount of the silver to be disintegrated from the ware. This of course results in the incrustation being removed also, and when the process is finished and the solution emptied out of the pan, there will be found a blackish deposit adhering to the sides and bottom of the aluminum vessel. This represents silver oxide and other matter which has been electrolytically removed from the silverware, leaving the latter in a practically new condition.

Contrary to general opinion, this process is not injurious to the silverware. The amount of silver disintegrated or deposited in the bath is so very slight that it amounts to almost nothing.

A recent report made to the American Chemical Society on this electrolytic method of cleaning silver by contact with aluminum in an alkaline solution, mentions among other things: that a number of careful tests proved that sodium carbonate was slightly more efficient than the sodium bicarbonate. The best concentration for the solution was found to be that calling for one teaspoonful of washing soda and one teaspoonful of table salt to each quart of water. Best results were obtained in these



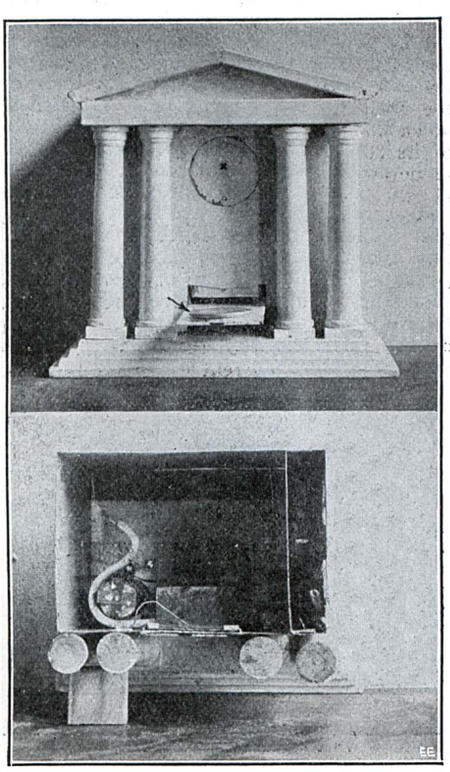
To Clean Even the Dirtiest Silverware, Procure an Aluminum Pan and Mix up a Strong Solution of Bicarbonate of Soda. Keep it Boiling and After the Spoons, etc., Have Laid on the Pan Bottom for a Few Minutes, They will be Found to be Thoroly Clean.

tests when the cleansing solution was maintained at the boiling temperature during the process, and aluminum proved more efficient than zinc for use as the active metal in contact with the silver.

Principally, this method results in a distinct saving in labor, and it is, besides, very convenient and clean. To quote the report in question: "It removes the tarnish from both the sterling and plated silverware without appreciable loss to the metal."

WHISTLE, AND THIS ELECTRIC TOY BANK GRABS YOUR COIN.

A very interesting electric toy bank has been recently invented by Christian Berger, the well-known inventor of the submarine wireless apparatus and of the various elec-



Whistle but Once and This Electric Bank Hustles Your Coin into the Vault.

tric toys which appeared some time ago in this journal.

The bank as it appears when finished is illustrated in figure. The mechanical and electrical details are apparent from lower figure. The novelty of this toy lies in the that that the coin which is to be deposited in the bank is placed upon a horizontal platform, and by the aid of a whistling sound it is automatically deposited. This is done by means of an electro-magnet acting upon the platform which is controlled by a special microphone, connected with a battery.

Referring to the second figure, it will be noted that the battery is held in a suitable receptacle as shown on the left. The coin door is in the foreground center and can be seen by referring to Fig. 1 (at the top) showing the circular opening. The microphone is located in the right compartment and consists of a fine wire pivoted on an insulating rod. The end of the wire bears lightly upon a piece of gold foil fastened to the side of the safe, which latter is made of thin sheet metal. The electro-magnet used for retaining the coin platform horizontally is located at the bottom. The connections are made the same as for the *Electric Dog,* described in our June issue.

The operation of the toy is as follows: The money which is to be deposited is placed upon the platform, Fig 1, which is pulled down until the electro-magnet holds it and keeps it in a horizontal position. By producing a sound such as clapping one's hands or whistling, so as to actuate the sensitive microphone, the coin platform is released instantly and deposits the money through the upper hole, Fig. 1.

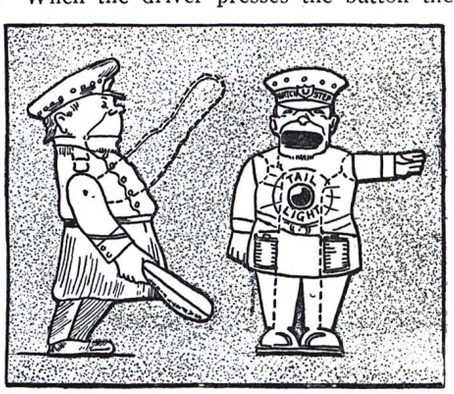
The safe is fitted with a door and lock at the back for the purpose of removing the money collected therein.

AN ELECTRIC MOTOR HORN WITH TRIMMINGS.

Henry Sieben, past wharfmaster and past master of plain and fancy inventing, has added another to his list of momentous contraptions; this is the way his local newspaper writes him up, at any rate. His latest claim to the title of champion heavyweight patentee of the United States is a combination electric motor horn and signaling device for the front and rear of a motor car.

The device consists of a handsome figure—the inventor says he will make it to suit any taste, from Venus to Charlie Chaplin—and a horn of unlimited possibilities. The horn possesses remarkable noise-producing qualities—enough to wake the dead, avers the sponsor of the magnificent looking specimen of manhood here portrayed.

When the driver presses the button the



At Left: New Shrieking Auto Radiator Decoration. At Right: Direction Indicator and Tail Lamp; Both Electrically Operated.

figure's arm goes up in a menacing manner, the mouth opens wide and wild shrieks issue forth. For the rear of the car Mr. Sieben has added a direction indicator and tail lamp to his device.

Should the driver desire to turn to the left, the arm of the figure in the rear will point in that direction. At the same time the mouth will open and the same wild shrieks emanate. On the figure's chest there reposes the tail light.

PICTURING ELECTRIC SERVICE TO AMERICA'S MILLIONS.

IMAGINE nearly 800 posters, all in colors, all by individual artists, and you have an idea of the task before the judges who recently selected the prize winners in the America's Electrical Week poster competition conducted by The Society for Electrical Development. The competition closed June first. Over 800 posters were received representing over $100,000 worth of designs.

Since America's Electrical Week appeals alike to rich and poor, man and woman, merchant and customer, artist and engineer, everybody was asked to suggest a fitting design to drive home into every hamlet and city in the land, the message—"Do It Electrically!"

The judges were unanimous in their choice—which is shown here. In colors it, of course, is many times more effective.

The judges are recognized as representative commercial art critics.

The poster might well be entitled "Aladdin; Symbol of Service."

Of all the Arabian Nights Tales, the story of Aladdin is, perhaps, the most fascinating. The all-powerful slave, who could be summoned by the mere rubbing of a mysterious lamp; the treasures thus at the command of the lamp's owner; these make a narrative which will live as long as the world lives. Yet the modern Aladdin, pictured in this poster, performs wonders that make the adventures of our Arabian Nights hero pale into insignificance.

Gone is the ancient lamp. Now it is the gentle touch of a button and forthwith comes the Genie, *Electricity*. He bears, not precious stones, but things far more precious—Light, Heat, Power. It is the power that makes the world go 'round, the heat that forever drives out cold, the light that turns night into day.

And this wonderful Genie comes and goes, as did Aladdin's, at our bidding. He is always "at your service." How better could the thought of America's Electrical Week, "Do It Electrically" be presented to the people?

This design will be used throughout the campaign, millions of poster stamps, window and car cards, lithographs, bill posters, in newspapers, magazines, etc. It will be reproduced at least 200,000,000 times.

America's Electrical Week Poster. Winner of Grand Prize of $1000 in Nation-Wide Electrical Poster Competition. Over 800 Leading Artists Submitted Designs. This Design Will be Reproduced 200,000,000 Times During the Big Campaign This Fall.

The posters were assembled for the inspection of the judges on June tenth in the Anderson Galleries, Forty-first Street and Madison Avenue, New York City. In accordance with the rules of the contest, the Poster Committee appointed by the America's Electrical Week Executive Committee, then turned over to the judges the entire collection of posters.

The judges were further instructed to select those posters which should be classified as eligible for the public vote to decide the winner of a special $300 Public Choice Prize.

In this way the Society for Electrical Development relieved itself entirely from the judgment of the posters and placed all the responsibilities in the selection of the prizes upon this Jury of Awards. The Society exercised no influence upon the determination of the prizes and left the decision of the awards exclusively to the judges.

After many deliberations, the judges eliminated all posters not entitled to be considered for the Public's Choice Prize. Some 125 posters survived this test. The judges then determined the winners of all of the prizes except the Public Choice Prize.

The prize winners were then voted on with the following result:

No. 717—the first prize of $1,000—Harold von Schmidt, San Francisco, Cal.

No. 174—the second prize of $500—John A. Bazant, Bronx, N.Y.

No. 452—the Art Students prize of $200—Edward Staloff, Jersey City, N.J.

No. 392—the first school prize of $100—Harold H. Kolb, Somerville, Mass.

No. 80—the second school prize of $50—Wm. E. McKee, Jr., Hollywood, Cal.

No. 84—the third school prize of $25—Armand Moreda, Brooklyn, N.Y.

No. 576—the fourth school prize of $15—Ruth M. Jameson, Buffalo, N.Y.

No. 720—the fifth school prize of $10—Edna E. Crowley, Chicago, Ill.

This decision made No. 717, entered by Harold von Schmidt of San Francisco, the official design for America's Electrical Week. It is interesting to note that this design, although not the winner of the Public Choice Prize, figured prominently in the public voting wherever exhibited; this fact confirms the judgment of the jurors that poster No. 717 carried a strong appeal to the public, and that the message of electric service at the push of a button set forth in the design "gets across."

LEAD LINED CABINETS REDUCE X-RAY BURNS.

In the illustrations shown herewith we see one of the latest French X-Ray examination cabinets which are used in the manner shown, the patient standing behind the cabinet and the fluoroscopic image being cast upon either of two rising and falling screens.

The X-Ray tube of large size, measuring about 12 inches in diameter and provided with water cooling attachments to carry off the heat from the heavy current used, is supported behind the patient so as to throw the X-Rays through his body onto the fluoroscope screen mounted in front of the cabinet. At the left of the picture may be seen part of the X-Ray stand and holder with regulating apparatus on it for timing the length of the radiographic exposure. This timing of the exposure is accomplished by means of a special clockwork mechanism.

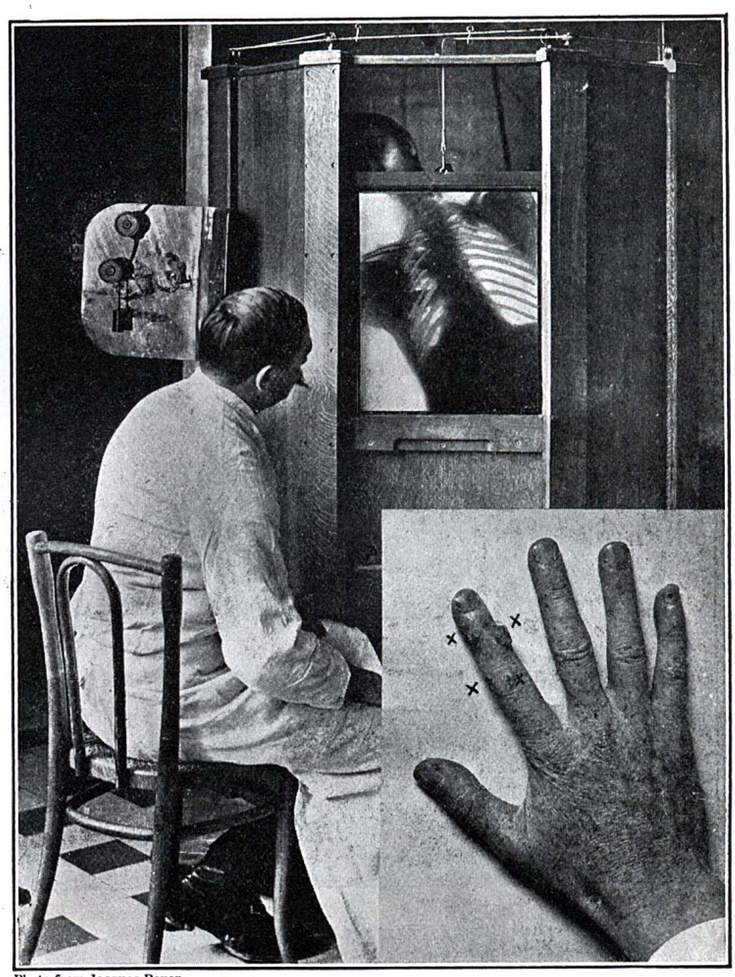


Photo from Jacques Boyer

French Physician Examining Entire Chest of Patient with High Power X-Ray Set. Insert View Shows X-Ray Skin Growths at X, Resultant from Over-Exposure to These Powerful Rays.

Naturally the exposure to the X-Rays must not be too long or else the patient is liable to have his skin burned. In the case of special investigations and where considerable research work is carried on in this direction there is a danger of contracting a serious growth caused by the X-Rays and a specimen of which is shown in the lower right-hand corner of the illustration—the growth somewhat resembles a wart, appearing in this case on the fingers of the hand and the principal ones marked by crosses.

The cabinet which encloses the patient as shown herewith is therefore lead lined, lead having been found to be a very good screen or shield for the X-Rays. The particular outfit here shown is of French design and there are also provided special rubber gloves impregnated with lead salts, which help to protect the surgeon and physician to a still greater extent.

The Sperry 1,280,000,000 C.P. Searchlight Throws Beam Over Fifty Miles

PEOPLE residing within fifty miles of New York City have been surprised to see an extremely powerful searchlight ray sweeping over the sky at night during the Fall months. This penetrating flash of light had its origin in Brooklyn, N.Y., where Mr. Elmer A. Sperry, the gyroscope specialist, and his engineers, have been testing out the merits of his new electric projector. It is said to be the most powerful in the world, its scintillating rays having been seen over 50 miles away. The searchlight shown in the photograph, Fig. 1, is nine feet high, while its accurately polished reflector measures five feet in diameter, and it produces a candle power of 1,280,000,000, which is *some* light.

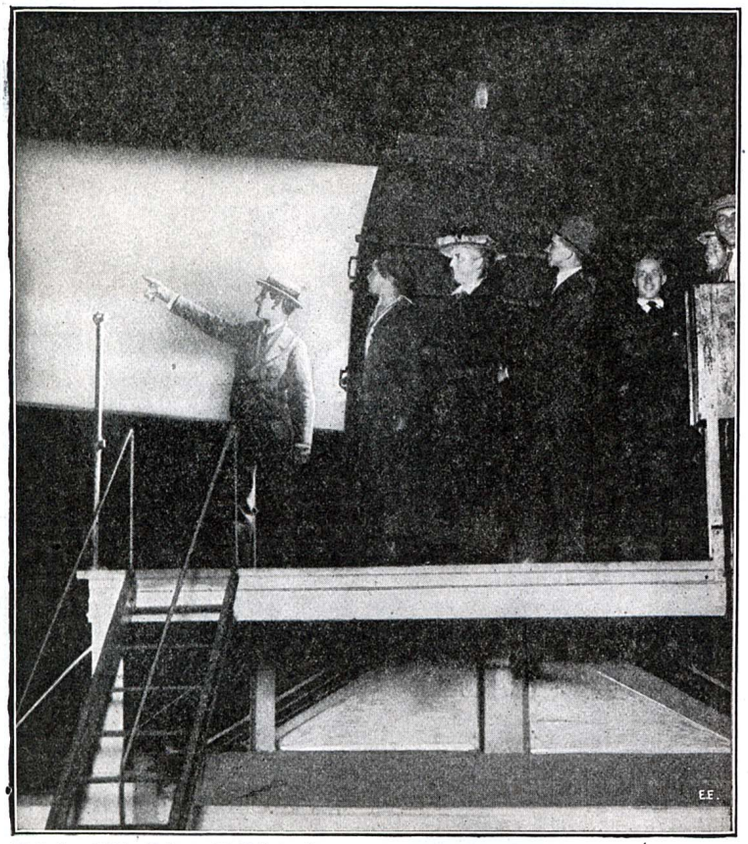


Photo Copyright by Underwood & Underwood.

Fig. 1. This Powerful Electric Searchlight Throws a 1,280,000,000 C.P. Beam of Light Which May Be Clearly Seen Over 50 Miles Away.

Up to the present the source of light which has been universally used has been the positive crater of a pure carbon arc. This pure carbon crater has a fairly constant brilliancy of approximately 150 candlepower per square millimeter, and it has been considered that this was the highest attainable brilliancy. It is true that the old standard searchlight arc gives the highest brilliancy obtainable from a heat radiating solid, since carbon has the highest melting point of any known element, but this brilliancy has been surpassed in the Sperry arc by making use, in addition to this heated crater surface, of a superheated vapor or gas produced in the arc, says Captain Adelno Gibson, of the U.S. Coast Artillery Corps in the *Aerial Age Weekly*. This superheated gas is formed from certain special materials that are powerful light producers and with which the positive carbon is impregnated.

For the successful use of this bright vapor as a searchlight source, it is necessary that it be concentrated in a very small area. This is accomplished in the Sperry arc by maintaining a very deep crater in the positive carbon and into which crater this bright vapor is kept pressed. This vapor causes the mouth of the crater to emit a very intense illumination running, for example, as high as 500 candlepower per square millimeter, or 320,000 candlepower per square inch. The force used to keep the vapor pressed back into the crater of the positive is the arc flame from the negative carbon and is similar to the arc flame used in the old standard searchlight lamps. The arc flame appears as a flame of considerable velocity emanating from the negative carbon, and gives but very little light in either the old or Sperry type of arc as compared with the positive crater.

The following tabulation of the specific brilliancies in candlepower per square millimeter, and which is rightly taken as the basis of efficiency-comparison for all arc work, shows this tremendous light intensity of the new Sperry arc:

Ordinary Tungsten filament..	2.4 to 5.4
Ordinary Tungsten filament, nitrogen filled	10.0 to 20.0
Tungsten at the melting point, (3500° C.)	72.0
Arc flame, ordinary white flame arc	7.0 to 20.0
Surface of crater "spot," flame arc positive.....	50.0 to 90.0
Crater surface pure carbon average	150.0
The Sperry arc being the candlepower of dense positive vapor in deep crater of a two-flame arc, special projector electrode	500.0
Sun at 30° elevation.....	775.0

Another distinct advantage which the new arc has over the older form lies in the very great reduction in area of the light giving source or crater. It is possible by using this new type of arc to concentrate the vapor into a crater which has a very much smaller mouth area than heretofore possible with a pure carbon arc of similar amperage. A distinctive advantage results from this reduction in area of crater, in that the angle of spread of the searchlight beam itself is materially reduced and the beam made much more nearly parallel throughout its length. For the standard 150 ampere arc, the diameter of the positive carbon is only 5/8 inch and that of the crater diameter somewhat less. The diameter of the negative carbon is only 7/16 inch and with its smaller holder casts a very much smaller shadow on the center of the mirror, thus, also, adding more reflected light to the beam.

The principle upon which satisfactory operation of this high intensity arc depends now shows itself to be entirely different than previously supposed. It was first believed that current density was the principal factor for the operation of such arcs, but we have found out experimentally by current densities ranging from 100 to 1000 amperes per square millimeter that current density is not the controlling factor, but that current value is the important factor.

It is evident that to obtain this highly concentrated light source and at the same time produce constantly a sufficient supply of bright vapor to fill the positive crater, a rapid consumption of the positive electrode is necessary. It is for this reason that the positive carbons are so much longer than those previously used, being 44 inches for the standard 150 ampere arc. In the old type searchlight arc rapid consumption of the positive was not necessary since the gaseous products were not used at all in the production of light, but in the Sperry type of arc this rapid burning of the positive is necessary to provide the light emitting gaseous materials.

The Sperry interests after two years experimentation with this new form of arc, are now manufacturing projector searchlights giving a candlepower intensity at the arc for a 36-inch size, which, aside from the accompanying reduction in the divergence of the beam gives an illumination on the target of six times that formerly obtained with the older type searchlight of similar diameter.

An elevation of the Sperry searchlight is shown at Fig. 2. The control box contains a shunt wound motor (right) direct connected to both a centrifugal blower and a gear train for the feeding and rotating mechanism. The blower furnishes air through two passages to the positive and negative carbon holders respectively. The air supplied to the positive holder is forced between a number of heat radiating discs which surround the end of the holder nearest the arc. The cap is open on the upper side to allow the air to escape from the positive holder. This method cools the positive carbon and also removes the heat from the mechanism of the positive carbon holder, received mostly by direct radiation from the arc.

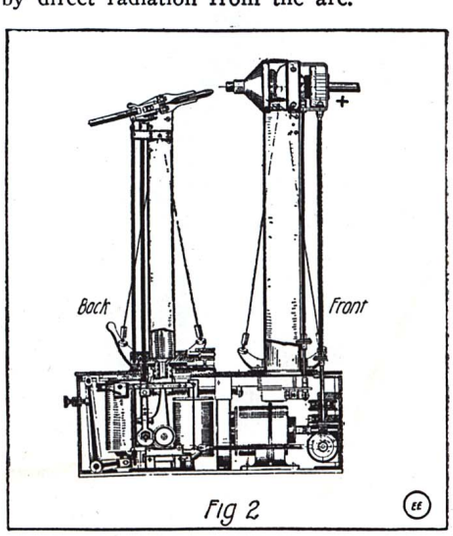


Fig. 2. Electrical Operating Mechanism of New Sperry Billion Candle-Power Searchlight.

The positive carbon is rotated, being connected to the shunt motor through a vertical shaft and a worm gear. A small

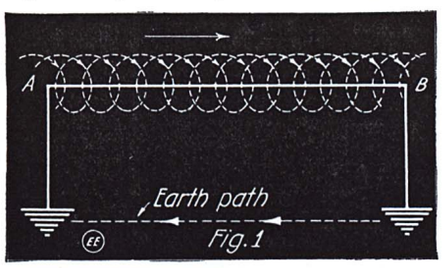
(*Continued on page 524*)

The Marvels of Modern Physics

By Rogers D. Rusk, B. Sc.

THE WIRELESS ERA.

THE Wireless Era is a name frequently given to the scientific period upon which we are now entering, by people who realize only vaguely themselves what they actually mean by it. In reality there



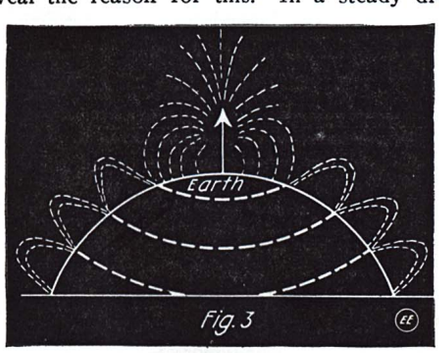
Illustrating How a Current of Electrical Energy Is Transmitted by Ether Whirls to a Point by a Conductor.

is a surprising relation between *wire* and *wireless* transmission. That they are not distinctly different phenomena may put new meaning in the phrase, "Wireless Era."

The question has often been asked "Will all wires be done away with in the future?" Now the theory most generally accepted at present is that the energy of an electric current in ordinary wire transmission does not reside *in* the wire, but in the ether surrounding the wire, and that the wire is, as its name implies, merely a conductor to conduct or lead the current here or there. To make this clear, let us imagine a current moving in the wire in Fig. 1, from A to B and returning by the ground. The dotted spiral lines represent the strain in the ether due to the electro-static and the electro-magnetic lines of force about the wire. The important point to notice is that the current, without this field, would be lifeless and inert because the magnetic field represents the energy of motion of the current; it would then have no energy of motion, for the energy is really stored up in the ether and is transmitted by it.

Let us look beneath the surface a moment at wireless transmission. In Fig. 2, the wireless waves are represented as traveling from aerial A to B. We cannot doubt for a moment but what the energy is transmitted by the ether, as no conducting medium is present. Therefore, the main difference between *wire* and *wireless* transmission seems to be that while in *wire* transmission the energy is directed to a definite point, in *wireless* it spreads out and dissipates itself in all directions.

A further study of Figs. 1 and 2 may reveal the reason for this. In a steady di-



This Diagram Gives a General Idea as to How a Radio Station Throws Off "Ether-Ripples" of Radiant Energy, the Same as When You Throw a Stone into a Still Pond.

rect current the field is steady and continuous. Change this current, however, to an alternating one and the field or ether strain varies accordingly, producing an undulatory motion of the ether. That is, the field about the wire rises and falls periodically. With an ordinary alternating current the strain in the ether is most noticeable just about the wire and becomes negligible a short distance away, although theoretically the waves may travel at each reversal a long distance before being dissipated. Let us raise the potential and frequency, however, and see what happens. The field rises to full strength in a very short time, and the waves follow each other at a greater speed. This means that radiation is going to amount to much more than before. The waves are going to be stronger, and their number will be multiplied many times. If instead of using a wire to direct the energy from A to B, we shorten the circuit very much, making it merely a local circuit at A, and if we put another small or local circuit at B, then some of the radiant energy from A will be intercepted at B, and these waves passing B will induce a slight current at B. *This* is wireless transmission. See what a gradual step it is instead of a very sudden one from wire to wireless transmission. In one case we have a small radiation factor, due to a real current in a conductor. In the other case we have a high radiation factor due to the absence of a long conductor. In the first the energy is directed; while in

FINAL CALL

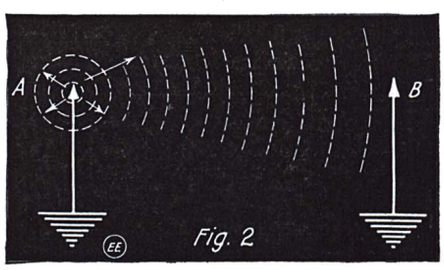
On November 1st, 1916, the subscription price of "The Electrical Experimenter" advances to $1.50 in U.S. (Canada and Foreign $2.00.) This is the last chance to subscribe at the old rates ($1.00 in U.S., Canada and Foreign $1.50). No subscription for more than five years at the old rate accepted. THE PUBLISHERS.

the second, it spreads out in all directions. The medium of transmission of the energy is the same in either case. The result is that in one case a large per cent of the energy reaches its destination, while in the other case only a very small per cent does.

The field about a wire carrying a direct current acts quite like an invisible whirlpool which pulls the electrons, or charged particles in the wire, along. The field, in turn, grows with the current, for the action is an inter-dependent one, and the result is a continuous current. If, with an alternating current, the oscillation frequency is high, the current does not have time between reversals to penetrate the wire deeply, and it is found that the current exists only on the surface of the wire. This is the well known *skin effect* and shows again that the energy must reside in the external field, and that it takes some appreciable time to start the electrons in motion. This is what we call a current *in a wire*.

Wireless telegraphy came into prominence in 1896, when Dr. Guglielmo Marconi first demonstrated its commercial value. Since then its importance has increased by leaps and bounds. The submarine has been directed from the shore by wireless; the human voice has been transmitted hundreds and thousands of miles; and various kinds of mechanism have been controlled by it. However, the glaring predictions of a wireless era for a while somewhat unduly inflamed the imagination of the public. Let us look at the facts.

It is very significant that one prediction of a few years ago has not been realized, and that was concerning the wireless transmission of power. *Power* and *energy* are



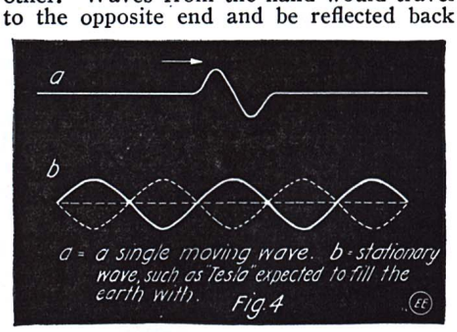
Representing the Detection, at a Point "B," of Radiant Electric Energy.

two different things. Energy is any capacity for doing work, while power is the rate at which work is done. Now sufficient energy may be sent across the ocean to easily operate a delicate detector, but the rate at which any work is done is ridiculously minute. Energy has been transmitted but the power was negligible. When a submarine is controlled at a distance, it is not power from the shore which operates the machinery, but rather *power* from some source on board the boat itself which is controlled by the *energy* transmitted from the shore. The strength of the waves decrease too rapidly with the distance to allow of any great amount of energy being transmitted. Most everyone remembers the rule that the intensity of light varies inversely as the square of the distance from the source. Applying this to wireless, and neglecting other losses, at the distance of one mile the energy would only be

$$\frac{1}{25{,}000{,}000}$$

of its original value. This in itself would stamp the wireless transmission of power as impracticable unless a different method of transmission than that now in use were discovered.

Nikola Tesla believed he had solved the problem and in 1905 took out patents for a system of wireless transmission of power, with the ether as the medium. In brief, by his system, he intended setting up powerful, stationary, electric waves, setting the whole earth in vibration due to the reflection and superimposition of waves from all parts of the earth. The principle is similar to that of a string tied at one end and waved back and forth by the hand at the other. Waves from the hand would travel to the opposite end and be reflected back



If we Tie a String at one End and Oscillate its Free End Back and Forth, There Will Be "Stationary" Waves Set up Along it as at B. Tesla Expected to Vibrate the Earth with such Waves.

(see Fig. 4) creating nodes and loops of vibration in the string. The proposition, it was claimed, had been partially demonstra-

(*Continued on page 538*)

Baron Münchhausen's New Scientific Adventures

By Hugo Gernsback

How the Martian Canals are Built

BEING the chief chronicler of a world-famous man is never an easy task. Famous men, as a rule, are most difficult of approach, as they have a mean trick of keeping aloof of the ordinary garden variety of humans. Not that they do not wish to have themselves chronicled in due and accepted manner, no, quite the contrary. They do. And they crave for publicity, more so than a stub-nosed society débutante, but they want the public to believe that they are far above such material things. They wish you to think that they are as modest as a spring violet, but down in their innermost innermostness, they like it if you climb to the top of a skyscraper proclaiming their greatness. Of course, they can't do it themselves, but they like to have it done for them, by some fool chronicler. This induces them to think that they are real modest, but I have found out long ago that modesty, like so many another vice is a business, a pretty little business at that, carefully studied and carefully plied to fool the public at large.

Now to chronicle the usual species of great man—see first paragraph, line one—is far from simple, even if you know the trick of chronicling. A simple recipe on the subject, therefore, might not be amiss. Proceed as follows:

Obtain a first-class introduction to the G. M. Next mix a fair amount of tact with a little of the G.M.'s accomplishments and his work. Mix with a generous quantity of soft salve and carefully cover the G.M. with same. The thicker you lay it on the better the result. Do not fail to tell him several hundred times that the public is starving for a message from him.

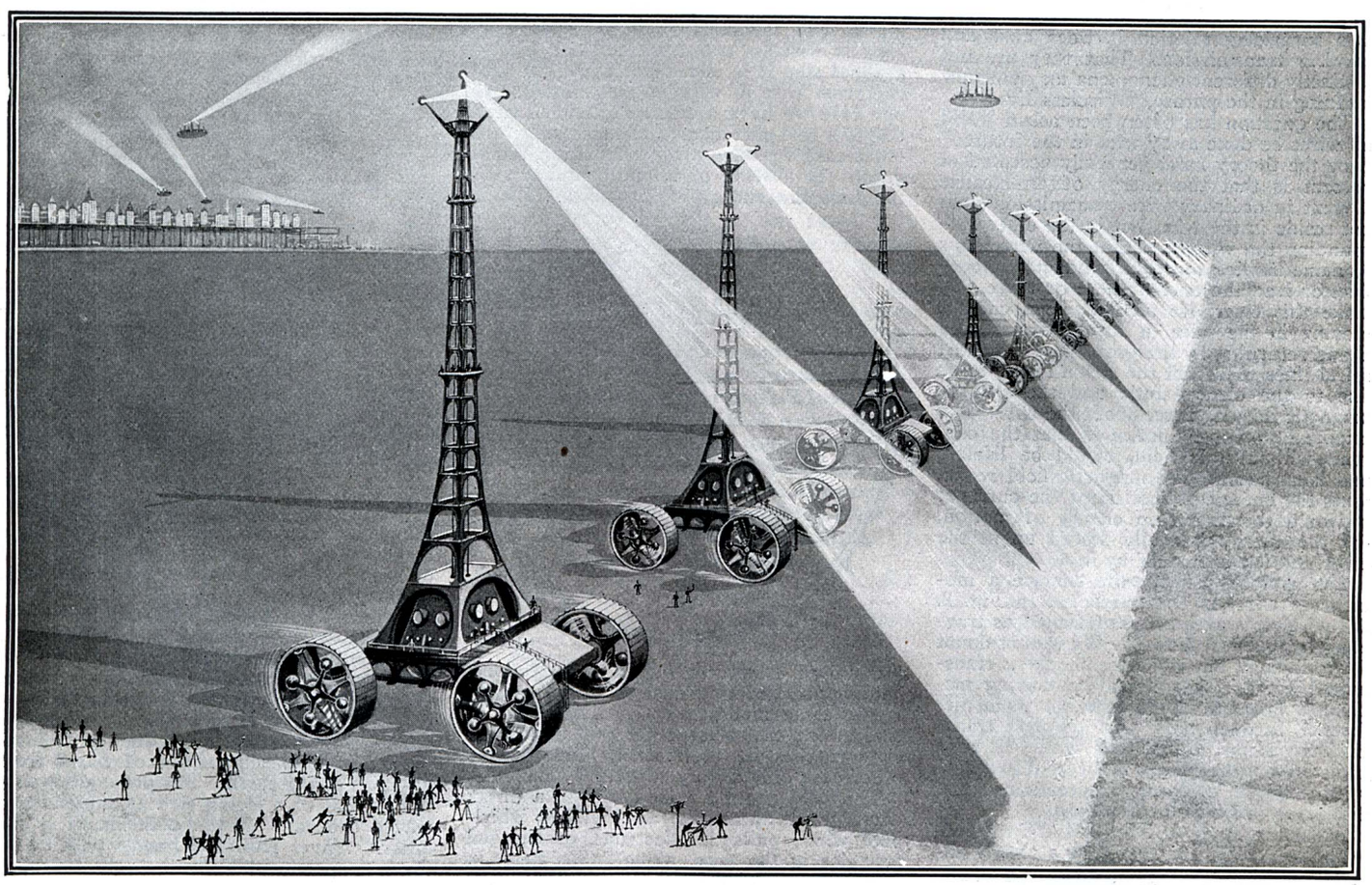
Once prepared in this manner, he will, as a rule, start to gush, hesitatingly at first. Apply more salve plentifully, rubbing it with the grain, *never* against it. As a rule the G.M. will now talk freely. All that is then necessary is to pull out your notebook and take down the precipitate as quickly as he talks. Embellish with scraps of your own imagination and the chronicle-compound is ready to be sold to the highest bidding magazine Editor-Gazink-in-Chief.

Which brings us down to earth, or rather away from it. For, if your great man is Baron Münchhausen and if the said Baron has taken it into his head to make the Planet Mars his abode, how can you chronicle him if he don't want to be chronicled, or rather can't?

What good is it that Baron Münchhausen has appointed me as his chief and uppermost chronicler, if the Planet Mars persists in rushing on through space, getting further away from the earth every day? Of course, I can't blame the Baron in the least, for he probably did his best to get his wireless messages down to me, but just consider for a moment what he is up against.

When I first began to take down my nightly reports from Münchhausen, the Planet Mars was near opposition to the earth. It was then about sixty-five million miles away from us. Gradually the distance was cut down to sixty million miles and his radio messages easily bridged this distance, enormous as it was. As will be recalled, the radio-telephone messages were recorded on the Baron's *Radiotomatic* plant, on the moon, erected there by him. This was done because the moon has practically no atmosphere to interfere with the weak impulses, after they traveled across the sixty odd million intervening miles. Recorded on the Radiotomatic plant, the messages were in turn amplified several thousand times and thence relayed across the comparatively short distance of 238,000 miles, separating the moon from the earth.

Thus every night I took down the Baron's messages and everything ran along like clock-work for many days. Münchhausen, of course, knew exactly whether the messages reached me or not, as he could readily check them. The Radiotomatic plant on the moon, as will be remembered, recorded the message, but did not send out the amplified message itself till several hours later, being thus regulated by clock-work. The impulses never were sent out till 11 p.m., Eastern terrestrial time. Thus the Baron, who, of course, had a very fine radio plant of his own on Mars, could hear his own message, as well as I could. For, if the radio waves were powerful enough to travel from Mars to the moon, they, of course, could travel from the moon to Mars, because the sending plant on the moon was even more powerful than the first one which Münchhausen had on Mars. It is just like an echo. If the voice



" . . . This ray which has the property of disintegrating the ground by breaking up the atoms of the desert sands, has immense inherent powers. The ground, rocks, sands, etc., everything "melts" before it, as snow goes up in steam before an oxyhydrogen flame. . . ."

Copyright by Hugo Gernsback, 1916. All rights reserved.

is strong enough to carry from you to the distant echoing wall, it will travel back just as readily, and you can hear your own voice. Thus the Baron heard his own message every day, just as well as I could.

But there came a time when the planet Mars, which travels in a vastly wider orbit than our earth, became outdistanced by the latter. Every day the two planets became separated further and further till finally Baron Münchhausen's Radio messages could no longer bridge the gap. It must be remembered here that the Baron made his trip in the *Interstellar* at the time of opposition of the two planets, i.e., when the two were but sixty million miles separated from each other. But when the last message reached me, Mars and the earth were already over seventy millions miles apart—almost twice as far distant from each other as when I took down the first message.

For days and weeks I waited nightly for the usual 11 p.m. message but not a sound came from my Radio Plant. I installed hyper-sensitive detectors, which became so sensitive that I could hear the waves sent out by a Ford Magneto at Melbourne, Australia! But all to no avail.

Of course, I knew that sooner or later the Baron would erect a higher powered sending machine on Mars, but it took him some months before he finished it.

In the meantime I was a chronicler without having anything to chronicle and everyone poked fun at me, as was usual when something went wrong with my plant.

Also, as was their habit, the Yankton papers began to lambast me in their usual style. The editors, it seems, had made it a point, before taking on reporters, to first try them out on me, and thus many rare and beauteous literary flowers bloomed in our local press. This is a fair sample taken from the Yankton *Trench Raider*:

PSEUDO SCIENTIST LOSES ETHERICAL WAVE-CONNECTION

Claims Earth and Mars Estranged. Are Suing for Separation!

Wuxtra! Wuxtra!! Lost! Wireless Waves between Earth and Mars.

Anyone finding stray wireless waves from Mars should promptly return same to 197 Mifflins Manor Road. Fabulous Reward. No answers questioned!

Perhaps, gentle readers, you won't believe it, but our self-appointed chronicler of the wondrous imagination, the Honorable I. M. Alier, the illustrous citizen of this Burg, lost his connection with that dear old friend of his, the venerable Baron von Münchenstiner. Our star reporter, who called on Honorable I. M. Alier yesterday to ascertain why the dear Baron, has of late been so extraordinarily quiet, was informed that the earth and Mars were on the "outs" again. You wouldn't suspect it of such an old married couple, but I. M. Alier informs us that every time the fossilized pair get together—opposition he called it—right away, instanter, they begin to oppose each other. She goes this way, he goes that. Shocking! And they won't "make up" till 1918. Isn't it scandalous?

At any rate, I. M. Alier says Münchenheimer is now seventy million miles away from us, whereas a few months ago he was only fifty million miles away. And he furthermore proclaims to all of humanity, and others, that Münchenhauser's wireless waves are no longer pow'ful enough to bridge the extra distance. Such are the fickle wavelets.

THE majority of our scientists today are in accord with Lowell's theory of the Martian Canals. That these canals exist, no one denies any longer. That they are artificial and that they carry waters to keep a thirsting planet from perishing seems pretty well established. But how such immense waterways, 3,000 miles long and 25 miles wide, could be constructed has been one of the greatest puzzles to science. In this instalment is advanced a new and fantastic theory on the subject. Will it seem so extravagant one hundred years from now?

Won't stretch a point; just like the installment house when the 269th payment is over due.

Our reporter suggested to Honorable I. M. Alier that perhaps the waves could be pieced together endwise and thus make them reach, but he received the suggestion coldly and without enthusiasm. The Honorable I. M. Alier seems to mourn greatly over the lost wavelets and the interrupted connection. But what would you do?

Cheer up, Honorable I. M. Alier. What's thirty or forty million miles and a few billion etheric waves between friends? Just think, the Baron might be on the Planet Neptune. And that old boy is 2,654,000,000 miles away! Just think of it!

Well, here's hoping that the Baron will soon find out a new brand of waves, to shoot at us. And let's hope that they are of the cold variety. Hot (air) waves have a short periodicity!

But everything comes to an end sooner or later. So one evening after I had resigned myself to the idea that I would not hear from Münchhausen, again till the 1918 opposition, I was suddenly electrified by an unfamiliar shrill, high-pitched note, coming in through my head receivers. The clock had just begun striking the eleventh hour, and I immediately knew that it must be the Baron.

The whistling note continued for almost ten seconds, running higher and higher till it finally went above audibility. Almost instantly the familiar sepulchral but sympathetic voice of Baron Münchhausen broke in my ears and I was overjoyed to hear him talk once more!

"Well, at last! How are you my dear Alier? Exhausted from waiting for my message that never came? I can readily sympathize with you, my dear boy, but you can imagine that it could not have been helped. Bridging seventy million miles by radio waves is no cinch, as you Americans are fond of saying. You will believe me when I tell you that my new Wireless Plant is a pretty little affair. It takes but a trifle of 300,000 kilowatts to operate it. A mere 400,000 horsepower! But you can rest assured that I will maintain communication with you even when Mars is in conjunction, that is, when the earth and Mars will be at their furthest separation, which is 230 million miles. That is the reason of the enormous energy. Of course, I am not using the entire 300,000 kilowatts as yet, but I will need the full energy when the two planets will be at their furthest separation. Professor Flitternix figured it all out, and he thinks too that we will be able to maintain communication when the sun comes between Mars and the earth. It is a task to send waves almost around and past the sun, which ionizes the ether for millions of miles around it, but we have fond hopes of maintaining an uninterrupted interplanetarian radio service in spite of the handicap.

But I am certain that my new radio plant, with its many unique innovations, does not interest you half as much as our doings on Mars. And, as the recorder on the moon does not hold long and extended messages, I must of necessity be short.

In my last message I spoke about Martian amusements and our visit to a Martian "showhouse." I will now try to explain to you how these wonderful people build their stupendous canals. I have already told you how the waters are moved in these canals on Mars, due to the indirect agency of the sun. I am happy in now being able to tell you from personal experience how these ponderous engineering feats are undertaken.

You are, of course, well acquainted with the fact how incredulous your scientists

(Continued on page 513)

DON'T MISS THE DECEMBER NUMBER OF THE "E. E."

The December issue of THE ELECTRICAL EXPERIMENTER will fairly teem with good things. A number of new authors will contribute to this Yuletide issue, which the editors are striving hard to make the very best one yet published.

There will be a special Xmas feature article, the latest news of the scientists, recent happenings in the realm of wireless, and all the usual departments. No matter whether you read THE ELECTRICAL EXPERIMENTER from the viewpoint of a layman or a scientist, you will surely find a full 15 cents' worth in the December number.

"Electric Submarine Camera." By H. Hartman, C.E.
"Baron Münchhausen" in another exciting adventure. By Hugo Gernsback.
A "Xmas" story thoroly seasoned with volts, ohms and amperes and a dash of "construction details" to tickle the Bugs' literary palate.
"The Marconi $1,000,000 Wireless Suit Against the United States Government." By A. Press, B.Sc.
"Reminiscences of an Electrical Trouble-Shooter." By H. de Scott.
"The How and Why of Radio Apparatus." Part Two.
"Announcement of the Results of the $25.00 Interrupter Prize Contest."
"Another Handsome Supplement Photo of a Well-known Radio Scientist"
"How to Build An Electrical Thermometer." By Samuel Cohen.
"The Measurement of Capacity."
Also there will appear the promised article on "The Revolving Mirror for Determining Spark Characteristics."
"Experimental Chemistry Course." By Albert Wilsdon.
"Marvels of Modern Physics." By ogers D. Rusk, B.Sc.

When Amateur Wireless Was Young

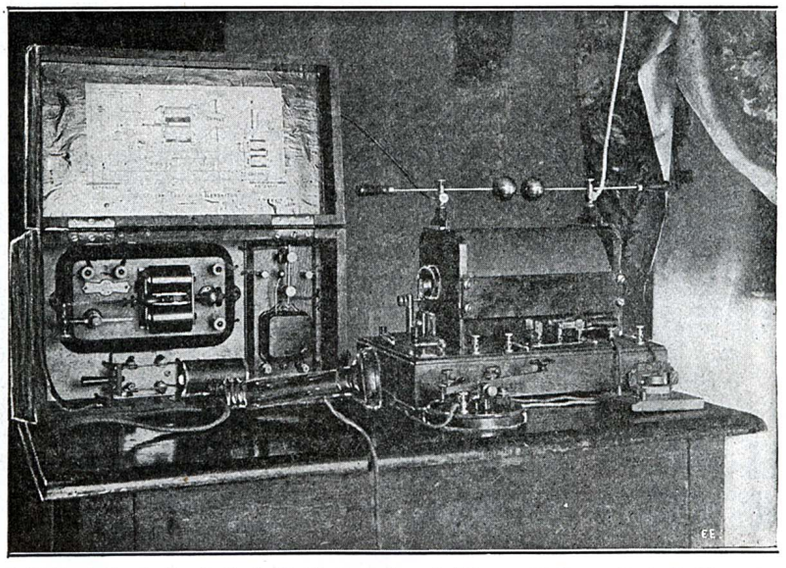
By H. de Scott

IT is a far cry from the modern wireless set rated at several hundred kilowatts and capable of hurtling forth its etheric waves over several thousand miles of space, to the small spark coil excited from a battery, with which Marconi and practically all other early radio experimenters worked.

Looking backward a few years the writer well remembers the early reports of Marconi's great successes in transmitting the now immortal 3 dots—representing the Morse code letter "S"—across the broad Atlantic from Cornwall, England, to Nova Scotia, Canada.

Interest in wireless matters ran high in those palmy days, when the amateur's aerial on the roof tops of lofty buildings was a rare sight indeed. But, so far as *electrical* experimenters went (we had no *radio* experimenters in those days), their interest might run high or at any old speed they liked, but one thing was certain: precious little information was available in book or magazine form for some years to come.

Around the year 1900 and in the next few years after that time, the author was residing at Trenton, New Jersey, and carried out a number of careful experiments on the old coherer type radio receiving sets. The first bit of information that he remembers reading was that endeavoring to explain how to construct a crude form of coherer. The patent specifications fairly teemed, of course, with very elaborate specifications on the construction of the improved Marconi type coherer, which was a very beautiful instrument, to be sure. But, in view of the fact that no air pumps were available and also as there was considerable doubt as to the size of the silver and nickel filings to be used in it and their quantity, little progress could be made with this data, at least at the outset.



A Relic of the Author's Early Radio Experimental Days. It Bears Mute Evidence to the Fact That There Was Such an "Animal" at Any Rate, Even Though Some of the Neighbors Swore It Was Nothing but a "Fake."

However, a hand-book which appeared about this time, contained the quite startling information that if we were to take two round carbon, motor brushes, and insert them end to end in a glass (boiler gauge) tube, and provided, however, that we had a small quantity of clean, soft, iron filings between the plugs, that this somewhat doubtful-looking device would respond to the etheric waves sent out by a spark coil discharge. This information seemed quite wonderful indeed of itself, and many doubts were expressed by the writer's electrical friends as to whether such a junky contraption would really attempt to work; in fact, as I recollect it, most of the conclusions were that it distinctly would not! However, one of these coherers was constructed and the next thing was to try out a scheme of pure, etheric wave wireless transmission without any ground connection. A spark coil seemed absolutely necessary, but as none was available a medical or shocking coil was pressed into service. This coil was hooked up with about 10 dry cells, and after fiddling around with it and receiving innumerable and unexpected shocks, we finally managed to obtain about 1/32 of an inch spark at the secondary. We found it necessary to connect a tin-foil and waxed paper condenser across the vibrator in order to obtain this spark, which tho small served our purpose.

At last the psychological moment arrived and everything was tuned up. No polarized or other type of relay was at hand, wherefore an old burglar alarm magnet coil, wound to 20 ohms resistance, was rigged up with a light, pivoted iron armature, so that when attracted by the electromagnet it would close a secondary circuit containing a vibrating bell. This was supposed, according to all documentary evidence on hand, to shake or tap the coherer filings back into their original state.

After spending several exciting minutes in quieting down the obstreperous coherer (not to forget for one moment the *always lively* de-coherer), it was finally possible to realize and perceive that wireless transmission was actually taking place. Not over a vast distance, like Marconi's, by any means, as the coherer was not much over three feet from the spark gap. However, this distance was finally extended to about 75 feet, after longer brass rods had been placed on the receiving and transmitting instruments to serve as antenna and ground capacities. These were old, brass-plated, iron curtain rods "swiped" from the kitchen window when mother was out to the corner grocery.

After several months of experimenting with about one thousand and one (including the famous "57") kinds of filing mixtures, containing all the know metals and some that were apparently unknown, the writer and his associates finally achieved a certain measure of success. A piece of No. 14 B.&S. gauge, rubber covered copper conductor was suspended on a bamboo fishing pole secured to the edge of the roof; the lower end of this crude antenna was taken in through a porcelain tube in the first floor window sash. A 2-inch spark coil, which the "general staff" had managed to design and construct by this time, was connected up to the water pipe and the aerial. The writer arranged to have one of the family close the key now and then (mostly then), so as to send out waves from the improved antenna while he sallied forth with the *trick box*, containing the receiving instruments in order to test the working range. For a receiving antenna, a piece of No. 14 cotton covered magnet wire was utilized, suspending it from a 10-foot clothes-line prop. The ground connection for the receiving set was formed by pushing a large size screwdriver into the earth, to which a wire was attached from the instruments. Happy to relate, the coherer and decoherer behaved quite intellectually for once, and the dots and dashes came tripping in, in apple-pie order, much to the bewilderment of several sidewalk bystanders.

The instruments were working over a distance of about ½ mile on the outskirts of the city, but inversely, the crowd was not very small. A duly uniformed bluecoat, better known to *radio amateurs* as a "cop" hove in sight. After removing his hat and mopping his perspiring brow, occasioned by his recent sprint, he managed to bellow out: "Wat ya got there, Bobby?" You see I had made up this outfit quite complete, even to a wiring diagram of the instruments which was of course conspicuously shellacked in the lid of the cabinet, and to be sure it carried in large size and thoroughly legible Roman capitals the word *Wireless*. That was enough to get the "cop" thoroughly interested. In fact, after he had listened to the spasmodic ravings and sputterings of the coherer and his twin-brother, the de-coherer, for a minute or two, he flatly refused to believe anything less than that the instrument was copying low-down racing reports *via wireless*. The climax of the matter was that he gave an imperative order to "close up that contraption and away with it." A little incident of this nature, however, did not deter the present scribe or his enthusiastic co-experimenters in the least. While experiments were being carried out with this crude but gradually improving radio experimental set, a number of rather amusing incidents happened from time to time.

One of these comes to mind vividly and happened thus: One day the spark coil and key were situated on the third floor of our domicile, while the innocent looking receiving cabinet was placed on the parlor table, with its two brass curtain rods projecting from either side in their most scientific looking manner. A number of the neighbors were present on this occasion, including several electrical "sharps," who, in their spare moments, dabbled now and then into the mysteries of the electrical art, even so far as to installing their own electric door bells. When everything was ready the spark coil was operated and true to nature the receptor responded promptly with a rat-a-tat-tat on the glass coherer tube for every spark. Those present were quite astounded at the uncanny performance and flatly refused to believe that any such mystical *animal* as a Hertzian Wave existed in the universe. To cap the climax, one of them finally suggested that we close all of the hall doors on every floor, as he felt sure that the messages came down the stairs to each floor and managed, somehow or other, to enter each door, so as to propagate themselves in a direction certain to reach the ever faithful receiving instruments. And so it went, much in accordance with that golden proverb—"Where Ignorance is Bliss 'tis Folly to be Wise."

Shortly after these experiences the

(*Continued on page 537*)

The RADIO LEAGUE of AMERICA

HONORARY MEMBERS
CAPT. W.H.G. BULLARD, U.S.N. NIKOLA TESLA.
PROF. REGINALD FESSENDEN. DR. LEE DE FOREST.

H. Gernsback, Manager

Activities of the New Britain Radio Club

THE New Britain Radio Club holds its meetings regularly at the New Britain, Conn., Y.M.C.A. every Tuesday evening. The fall season opened on the twelfth of September. The roster of members at present numbers 42, but only 30 are shown in the group photograph, as many of the members joined after the photograph was taken.

All the members of the club have radio sets, of which they indeed may well be proud. Messages are received regularly by many of the members joined after the pholington, Va., and from battleships located far out at sea.

Every Tuesday evening the members of the club gather in their room at the Y.M C.A. where discussions are held on various wireless subjects. There is hardly a member owning a station but who can rightly boast of some parts of the outfits that were home-made. Indeed, there are instances where sets in their entirety have been made by certain of the young men whose mechanical ability stood them in good stead.

Francis A. Mulvihill, president of the club, has been an untiring worker for the success of the organization. His talks on wireless apparatus and long-distance sending have been highly beneficial to the members. He is one of the oldest operators in New Britain and is, therefore, possessed of a broad knowledge of wireless work.

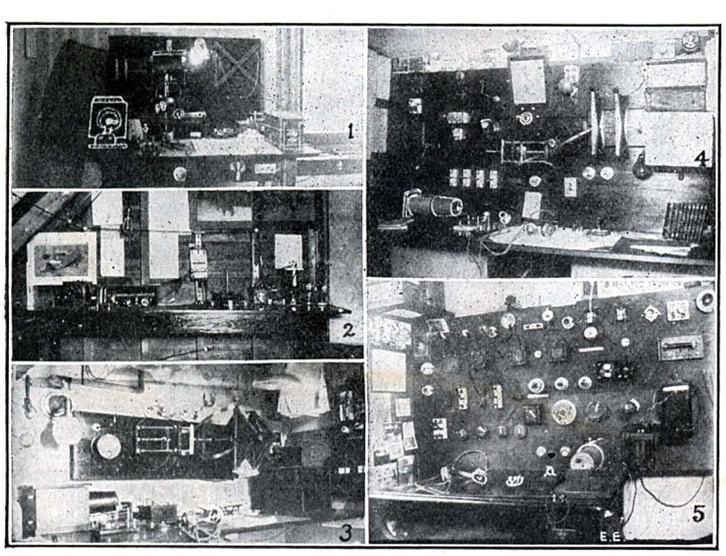
Walter J. Doyle, vice-president, and Alexander V. Bollerer, secretary, have accomplished much good work and both are well versed in wireless subjects.

Alexander V. Bollerer has devoted much of his time to the club, giving lectures on wireless and electrical apparatus, which were of great interest to the members. A 100 per cent attendance is always the rule when Mr. Bollerer is scheduled to speak.

The club has a 1 K.W. set for sending purposes. For receiving they have a 4,000 meter loose coupler and two Audions, which are operated by storage batteries. They also have six pairs of 2,000 ohm 'phones, and one pair of 3,500 ohm 'phones. The club has no official call, but has adopted the letters "MO."

The Members and Officers of the New Britain Radio Club of New Britain, Conn. The Members Have Excellent Radio Stations at Their Homes and the Club is in a Flourishing Condition

The sets shown represent the best of those owned by the members. The owners of these stations are Alexander V. Bollerer, Francis Mulvihill, Wesley Parker and Robert Yuon.



Club Members' Radio Sets. 1—Mr. Parker, 2—Mr. Yuon, 3—"Club" Set, 4—Mr. Mulvihill (President), 5—Mr. Bollerer (Secretary).

It will be recalled that Mr. Bollerer was the prize winner in THE ELECTRICAL EXPERIMENTER, the June issue. Below is a description of his set.

The sending set of the station comprises a Blitzen 1 K.W. transformer, 110 volt rotary spark gap with an oscillation transformer and suitable condenser, also a key with large, heavy contacts. The receiving set consists of the following: Long wave loose coupler, having a Murdock variable condenser shunted across the secondary; also a condenser in series with the ground lead to vary the (short) wave lengths of incoming stations.

In the secondary circuit there is an E. I. Co., sliding plate condenser in shunt; the two latter condensers are controlled by the two S.P.S.T. switches on the switchboard at the left.

Now a word about the detectors. There are four, one silicon, one galena, one Audion and a Radioson. These are connected to the loose coupler by a switch system. There are two D.P.D.T. switches employed, the leads from the secondary of the coupler running to the center of one, and the center pole of the second switch connected to one side of the other; thus allowing the operator to use any detector simply by a throw of the switch.

There are two sets of 'phones in the station, one Brandes' 3,200 ohm "Navy," shown on the table, and the other an E.I. Co. 3,000 ohm "Government" set. By means of the four point switch it is possible to connect either pair of 'phones to the detector.

The two aerials which are employed at this station may be used independently of each other, or together, as the operator so desires. One is composed of two wires, 50 feet high and 80 feet long, and the other is 375 feet long and 85 feet high; both are made of phosphor bronze wire.

The station is located in Mr. Bollerer's bedroom and it affords him great pleasure to spend the evenings there, listening to various stations working all over the country

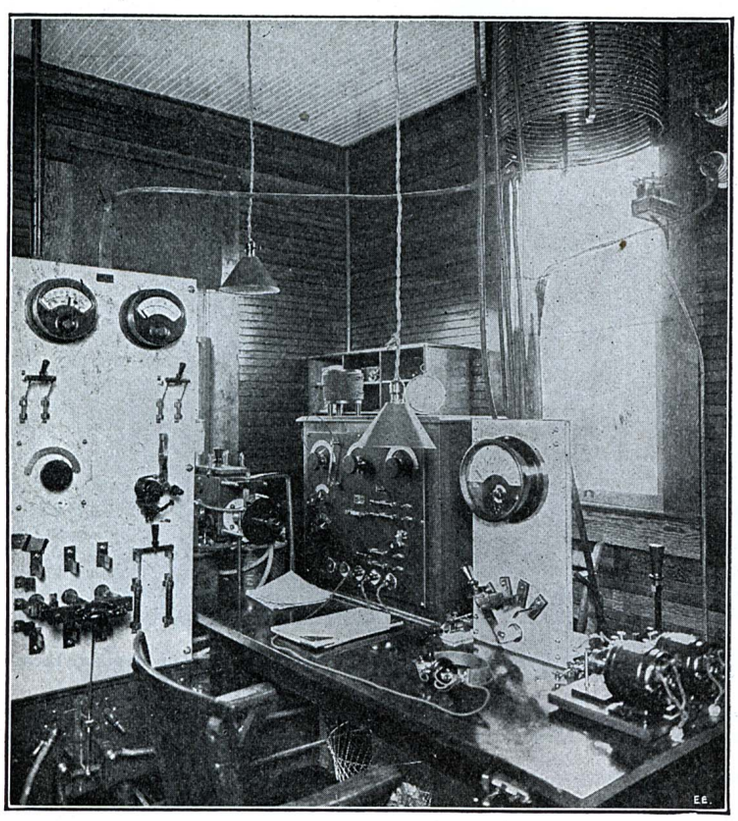
(*Continued on page 528*)

A 10 K.W. Poulsen Arc Radio Station

THE accompanying photograph shows a typical Poulsen arc radio station, which is located at Central Point, California.

The transmitting outfit consists of a 10 k.w. Poulsen arc generator, as seen on the left of the switchboard. The large insulated knob in front of the arc is used for regulating the distance between the electrodes. The oscillating circuit, which is composed of a high tension condenser located below the switchboard, while the inductance seen in the upper right-hand corner, is also used as the aerial helix. The antenna radiation ammeter is located on the small switchboard on the operating table. The four-contact knife switch below the meter is used to obtain four different wave lengths. Each switch jaw is connected to a proper number of helix turns by a heavy, insulated metal ribbon conductor. The operating key is seen on the left of the aerial control switchboard.

The receiving cabinet is seen to the right of the arc. This is a standard Poulsen tikker receiving set, comprising two variable condenser capacities, which are controlled by insulating knobs placed on top of the cabinet. The central one operates the inductance value of the tuner, while the two lower ones on the left control the mutual inductance between the primary and secondary coils. The detector employed in this system is a tikker of the imperfect contact type. This consists of a wheel with a rough surfaced groove, driven at a high speed by an electric motor. Two fine gold wires gently press against this groove surface. There are two tikkers used in this station, one for continuous duty, while the other is used for emergency. These are seen on the extreme right of the photograph. The connections for the tikkers and phones are obtained with the jack plugs seen at the lower side of the cabinet.



A Typical Poulsen Arc (Undamped Wave) Radio Station Located at Central Point, California. The Small Motors on the Table (right) Drive the "Tikker" Wheels.

Excellent results have been attained at this station and it is expected that the company will enlarge the transmitter. Poulsen arcs have been developed now ranging in size from 30 to 60 kilowatts.

COURT DECLARES AUDION AN INFRINGEMENT ON FLEMING VALVE.

The contention of the Marconi Wireless Telegraph Company of America that the de Forest Radio Telephone and Telegraph Company had infringed its rights to the sole use and ownership of the patent covering the Fleming valve detector was sustained on September twentieth in an opinion written by Judge Julius M. Mayer of the Federal District Court at New York. Dr. John Ambrose Fleming, an English scientist, invented the detector in 1905, and almost immediately thereafter the Marconi Company obtained the rights to its use.

While the invention is more than ten years old, it has never been improved upon by any other discovery for making more resonant the messages sent through the air. It was preceded by many other contrivances, variously known as the coherer, which was a glass tube filled with filings; the crystal detector, the magnetic detector and the electrolytic detector invented by Professor Reginald A. Fessenden.

In his decision Judge Mayer said that no matter what differences of opinion might exist between men of science in respect to the theories by which they accounted for the movement and action of the unseen forces, concerning which testimony had been taken during the trial of the cause, the solution of the issues at bar was not very difficult, because courts placed their decisions upon things demonstrable and could speculate as to theories concerning which even authorities did not agree. The decision read:

"Within the limits of an opinion it is, of course, impossible to analyze at length a mass of experiments, tests and theses, and an infinity of detail necessarily involved in testimony of experts in an art of this kind. But if plaintiff's (Marconi Company) theory that its own device and that of defendants (de Forest Company) operate on the same principle has not been proved, and I think it has as far as such proof is possible—at least defendant's theory has not been demonstrated and, finally, the physical facts all support plaintiff's claims."

Judge Mayer complimented Dr. de Forest on the contributions he had made to science. Then the court found for the plaintiff, dismissed the counter-claims made by the defendant, but said that there was no evidence against Dr. de Forest personally.

It is interesting to note that in the wording of the decision handed down, there is apparent the idea that the defendants quite possibly have an instrument whose mode of action involves some, as yet, undemonstrable technical details. Undoubtedly there is some minute scientific phenomena that occurs within the Audion that is not fully understood, even by the leading scientists. Several eminent savants have hinted as much in a number of instances.

The Judge admits that the introduction of the grid electrode by de Forest was a most important advance in the art—a truth emphasized by the fact that since its first disclosure tens of thousands of grid Audions have been employed the world over, as against a few hundred two-electrode lamps—and almost no genuine rectifiers as disclosed in the original Fleming patent.

During the course of the trial the de Forest Co.'s experts demonstrated that electrical rectification between the hot and cold elements of an Audion played no essential part whatever in the operation. Bulbs were tested having one, two, and finally three incandescent electrodes—i.e., filament, grid, and anode, all incandescent, heated from separate batteries. The actions and sensitiveness of these Audions was unchanged as grid and then anode were brought from cold to the same temperature as the filament. In this state either electrode could be made to play the part of "filament," "grid," or "anode"—indifferently; thus proving that the rectification principle on which the Fleming Valve avowedly does and must operate plays no part whatever in the Audion.

Dr. Lee de Forest, president of the de Forest Radio Telephone and Telegraph Company, said that an appeal would be taken from Judge Mayer's decision by his company. He added that while the Marconi Company also was found to have infringed, he believed they would not appeal, since the royalties they might be able to exact from the de Forest concern for infringement of the Fleming valve patent would be far in excess of the amount they would be called upon to pay for infringing on the Audion amplifier. The latter, he said,

was widely used, particularly by the American Telephone and Telegraph Company on its trans-continental lines and by amateur wireless operators all over the country, while the United States Government had bought more than 10,000 of them. The infringement decision, he explained, lay in the fact that the Audion amplifier made use of an incandescent electric bulb, though this was employed in taking practical advantage of a principle altogether different from that upon which the Fleming valve was based, though the latter was the first device embracing the use of an incandescent lamp to be patented. Dr. de Forest said further that he believed the Marconi Company would not attempt to force discontinuation of the Audion device, as, he said, it had proved a far more satisfactory amplifier than the Fleming valve.

NEW SHIP RADIO RULES IMPOSED.

New instructions to masters of ships of the warring nations regarding the radio outfits of ships have recently been issued by the government authorities as follows:

"Upon arrival inside of the three-mile limit, disconnect aerial. No further use of radio set permitted except in an emergency or as stated below.

"Current off the radio, both emergency and main set.

"Plant must be available for inspection at any time night or day.

"In case repairs to the set are necessary the radio neutrality inspector must be communicated with at once, as in case any seal may be in doubtful condition.

"No tampering with seals after they have been placed, except by a radio neutrality inspector or duly authorized person.

"Sets after clearance may be placed in condition for use upon arrival at the three-mile limit, upon obtaining permission of the collector of the port.

"Vessels calling for bunkers whose stay is less than twenty-four hours are not ordinarily required to disconnect, nor is the set sealed, but they must not use it for sending or listening in."

AEROPLANE RADIO TEST.

What is regarded by army aviators in San Diego as one of the most notable achievements in American military aeronautics was recorded during the past summer, when Captain Clarence Culver of the San Diego aviation school, kept in radio communication with North Island, San Pedro and Dominguez Field in Los Angeles during a flight to Santa Monica and return.

The distance covered was approximately 230 miles and the messages were sent at ten-minute intervals. Lieutenant W. A. Robertson, who handled the receiving instruments at the army aviation school, said that every message was recorded with amazing clearness.

Captain Culver, whose military aero tractor was piloted by Sergeant William Ocker, left the North Island aerodrome at 9:30 o'clock in the morning. Flying at an altitude of one and a half miles, the aviators circled over Los Angeles and then headed for their destination point, Santa Monica.

The radio set used by Captain Culver was invented by himself. The apparatus, weighing less than forty pounds, was attached to the lower section of the aeroplane, and the power for transmission was derived from a generator that was specially constructed and driven by the aeroplane engine.

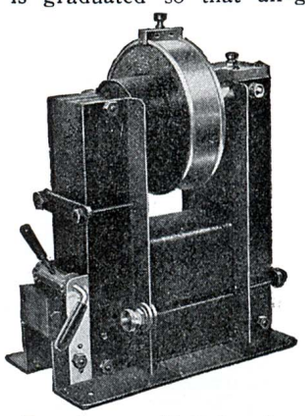
MARCONI SAYS WE'RE SAFE.

Our wireless friend Marconi says the United States can't be invaded. Yes, and there was a time when the wireless telegraph was looked upon as an impossibility, Guglielmo, my boy.

NEW WIRELESS TRANSFORMERS.

A Western manufacturer has placed on the market a new type of wireless transformer for amateur use.

The experience which this company has had in the wireless field is used to good advantage in the several new mechanical, electrical and magnetic features which appear in the new type as improvements over the old one. From a mechanical standpoint, the advantages are that all heavy and cumbersome castings have been eliminated and the structure is of pressed or stamped sheet steel and brass. This eliminates the possibility of breakage and reduces the weight approximately 2 per cent. Reduction of the cross section of the frame-work naturally decreases the sectional area open to the eddy currents. This feature, therefore, improves the efficiency of the device. The magnetic circuit of this new transformer is similar to previous designs, in that the external magnetic shunt is used. There is, however, one very important improvement that, instead of varying the entire magnetic shunt circuit by means of a spring and wing nut as heretofore, the magnetic shunt circuit is rigidly and securely held in place, the only movable portion being a small "V" shaped laminated steel tongue which moves in and out of the shunted magnetic circuit, varying the width of the air-gap and thus yielding any required regulation. The movement is accomplished by means of two geared wheels that engage either side of the tongue. On the same shaft is also placed an eccentric cam which readily locks the tongue in any position. The movable tongue is graduated so that air-gap can be readily adjusted for any current input desired.



Wireless Transformer with Unique Impedance Adjustment.

The primary and secondary windings are disposed on opposite legs, the primary being on the lower one. This high tension coil is extremely well protected mechanically by a band of heavy metal which covers the outer surface. This band is so constructed as to eliminate corona effects, this in turn reducing the liability of flash-over to a negligible quantity. The high tension coil is wound in layers with special insulated paper between, the edges of this paper being folded back, thus preventing the wire from slipping out of place.

There are no high-tension bushings or cable to this transformer, the metal shield of the secondary windings forming one terminal. One valuable feature of this transformer is that it is moisture proof. To demonstrate this fact one of these transformers was immersed in water. After being taken out the faces of high tension coil were dried with waste and transformer when tested under this condition, indicated no insulation weakness.

GALLETI WIRELESS TO BE DEVELOPED.

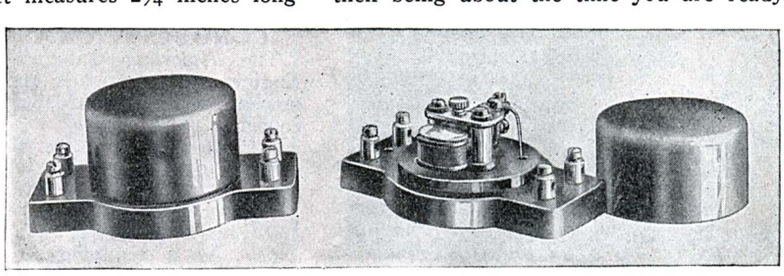
The Indo-European Telegraph Company, Ltd., London, England, states that owing to the continued interruption of the company's route during the whole of 1915, the actual receipts were confined to local traffic. It has been impossible to make final arrangements for the re-establishment of the route. Under the existing arrangements with other companies and administrations the company's receipts have not been prejudicially affected, but the directors foresee a diminution in the receipts for 1916.

On this account the company thinks it advisable to develop the Galleti wireless patents and to this end has entered into a new combination of interests with the firm of Creed, Bille and Company, Ltd., of London for the development of the wireless side of the business, for which purpose the Creed Company will be enlarged. It is the intention of the Indo-European Telegraph Company to utilize the wireless art in connection with its cable and land line system to span the gaps so long interrupted through the countries at war.

NEW HY-TONE RADIO TESTING BUZZER.

The radio experimenter and operator is always on the lookout for a reliable, hy-note testing buzzer. Here is the latest product of this type, and it is capable of operating on one dry cell. It simulates the pitch or note of high frequency radio transmitters, and will operate continuously for hours at constant amplitude without changing its period. It is easily adjusted over a wide range. It measures 2¾ inches long by 1⅝ inches wide, by 1⅛ inches high and weighs but 1½ ounces. The two pairs of binding posts (one pair for battery connection and one pair for connection across the break) are arranged outside the case so that connections can be made without removing the cover and no holes need be bored for bringing out wires when mounted on a cabinet or table.

A condenser and inductance connected across the contact points of this buzzer provide a source of oscillations of constant amplitude and constant wave length for laboratory and testing purposes. Such an instrument should fill a long-felt want in experimental radio laboratories, as the home-made test buzzers either have a "frog" tone or else they have a note that passes thru several octaves of the musical scale every now and then; said now and then being about the time you are ready to balance your wave meter for an accurate measurement.

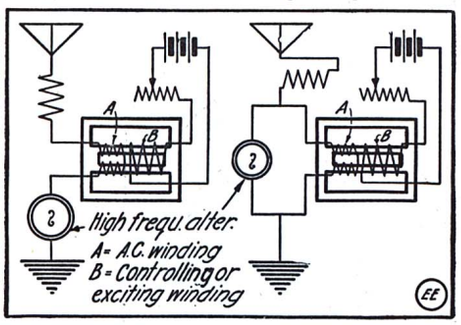


High Frequency Buzzer Recently Perfected for Testing Radio Detectors, Besides Serving as a Source of High Frequency Oscillations for Measurements.

The six state capitals of Australia have been connected by wireless telegraphy.

A NEW MAGNETIC AMPLIFIER FOR WIRELESS PURPOSES

One of the principal functions to be performed in modern radio work, especially where large quantities of power are to be regulated and controlled, as in wireless telephony, is that involving *amplification.*

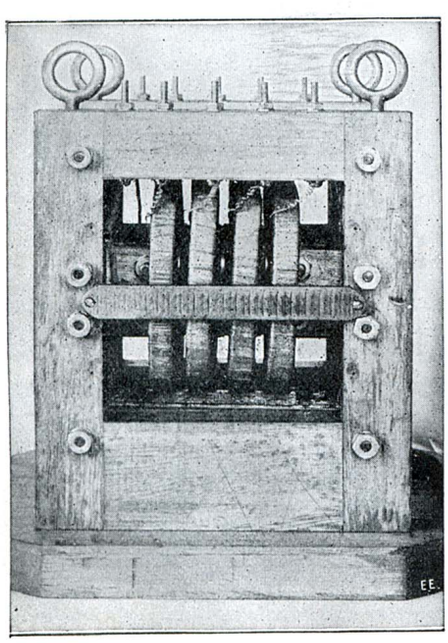


Schematic Arrangement of New Magnetic Amplifier Which Operates on a New Principle of Unbalancing the Magnetic Flux Due to D. C. Excitation.

Amplifiers represent one of the leading factors in modern radio research work. They have many applications indeed, and one of the latest is the magnetic amplifier, which was recently described before the Institute of Radio Engineers by Mr. E. F. W. Alexanderson, of the General Electric Company.

This scientist, as is well known, has performed a vast amount of commendable research work in the radio field, particularly on extra high frequency A. C. generators, delivering oscillating currents with a periodicity of 200,000 cycles per second.

Referring to the accompanying diagrams, Figs. 1 and 2, we have two magnetic windings A and B related to one another magnetically and grouped on a laminated core structure in the peculiar fashion shown, there being a slot left in the central leg of the iron core. It is apparent that there can be no direct transformation of energy from one winding to the other for the reason that each turn in the exciting winding B, includes both the positive and the negative branches of the flux, produced by the alternating current winding A, which is connected in series with the high frequency alternator or other source of oscillating



Appearance of 75 K.W. Alexanderson Magnetic Amplifier.

current. Hence there is no voltage induced in the winding B. However, the current in either of the windings A or B influences the permeability of the common iron core, and therefore changes the inductance value of the other winding. Should the current flow in either winding be sufficient to saturate the iron core, it is therefore rendered practically non-magnetic and the inductance of the second winding is reduced to the value it would have, if the coil included only air. When, however, a current flows in the other winding which gives a magneto-motive force equal and opposite to the first, the iron core is rendered magnetic again. As the two divisions of the A winding are wound relatively opposite to the B winding, the one branch will oppose the ampere turns of B on one-half cycle and the other branch during the successive one-half cycle.

The opposing ampere turns must be at least equal to the ampere turns in the winding B in order to have any flux variation in winding A.

The relations of currents in these windings is substantially the same as between the primary and secondary current in a transformer, although in this case one is an alternating and the other a direct current, or a current of a different frequency. It is thus obvious how the current flow in winding A can be regulated in proportion to the controlling current in winding B. When the magnetic amplifier is used in shunt to a high-frequency alternator, having a solid steel rotor, it has the immediate object of controlling the voltage rather than the current. The aggregate of the constant-field alternator and the stationary device A B has the effect of a machine with variable field excitation.

As indicated in the diagrams, it is possible to connect the amplifier either in series with the alternator or in shunt to the alternator. Of these two arrangements, the shunt connection is preferable. Mr. Alexanderson's paper develops in some detail the theory of the ratio of amplification, together with characteristic curves for series and multiple connection of the two alternate current windings with various condensers and tuning inductances. Various arrangements of this amplifier in connection with a solid steel rotor, radio frequency alternator, are shown, notably those in series with the alternator and those in parallel. Short-circuited condensers are connected to each of the radio frequency coils. A shunt condenser across both coils and their short-circuiting condensers increase the sensitiveness. Another condenser inserted in series with the entire amplifier is employed to obtain linear proportionality of amplification and increased sensitiveness. The ratio of amplification is found to be proportional to the ratio of the frequency of the radio current to that of the controlling current. For telephone control the amplification ratio varies from 100 to 1 up to 350 to 1. The paper describes, with oscillographic curves, the actual effects occurring in controlling the out-put of a 75 kilowatt radio frequency alternator.

CONDUCTIVITY OF COPPER.

The American Institute of Electrical Engineers recommends the following as normal values for standard annealed copper:

(1) At a temperature of 20°C., the resistance of a wire of standard annealed copper one meter in length and of a uniform section of 1 square millimeter is 1/58 ohm = 0.017241....ohm.

(2) At a temperature of 20°C., the density of standard annealed copper is 8.89 grams per cubic centimeter.

(3) At a temperature of 20°C., the "constant mass" temperature coefficient of resistance of standard annealed copper, measured between two potential points rigidly fixed to the wire, is 0.00393 = 1/254.45.... per degree centigrade.

(4) As a consequence, it follows from (1) and (2) that, at a temperature of 20°C. the resistance of a wire of standard annealed copper of uniform section, one meter in length and weighing one gram, is (1/58) × 8.89 = 0.15328....ohm.

Copper Wire Tables. The copper wire tables published by the U.S. Bureau of Standards in Circular No. 31 are adopted.

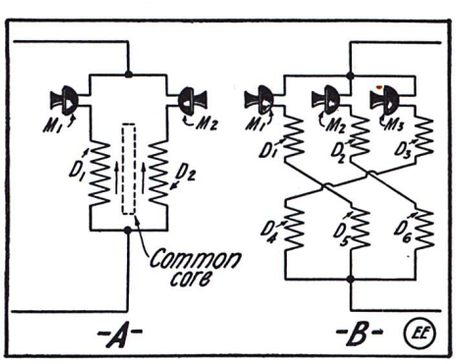
USING TYPEWRITER SPACE BAR TO LEARN CODE.

The wireless "bug" who during his hours of sanity is employed in an office can keep in fine practice by operating the *space bar* on a typewriter, which, because of its sensitive touch and loud after-click, answers very well as a substitute for a *key.* The beginner also will find this a practical way of learning.

Contributed by JOHN T. DWYER.

CONNECTING MICROPHONES IN PARALLEL

Dr. Rudolph Goldschmidt has given in British patent specification No. 15,915, 1912, a method of connecting microphones so as to be worked in parallel satisfactorily. As it is impossible to make two microphones that will remain perfectly alike electrically, it has hitherto been advantageous to use microphones in series. Goldschmidt's invention overcomes the difficulty for a pair of microphones by placing in series with each microphone, a coil so wound that the surging of the compensating currents, which always arise through unequal operation of instruments, is prevented by the mutual inductive action of the coils.



The Goldschmidt Scheme for Hooking Up Microphones in Parallel, Where Extra Heavy Currents Are to be Handled.

Fig. A, shows the arrangement where, M_1 and M_2 are the microphones, and D_1, D_2, are coils wound oppositely on a common core. Equal currents down the coil cancel each other's magnetic field, but a circulating current would build up a field, and, therefore, experience a considerable choking effect. When more than two microphones are to be connected in parallel they may be caused to work uniformly by pairing them and applying the above method.

However, a more advantageous arrangement is that shown in Fig. B, where coils D_1 and D_4 act on each other, and the remaining coils are paired similarly.

Still another method is given in the specification. A coil in series with each microphone acts on one and the same secondary current. If the microphones operate unequally, the presence of the secondary tends to choke the circulating current; if they operate equally the secondary current tends to neutralize the self-inductance of the coils. These methods promise to be of importance in radiotelephony thinks Dr. Eccles, the well-known radio scientist.

Telephones are rapidly displacing telegraph systems on several important railroads.

The How and Why of Radio Apparatus

Each month we will describe one particular instrument used in either the radio transmitting or receiving set, explaining just how it works, and why. We have received so many requests from new readers asking for such explanations, that we have decided to publish this matter in serial form. In the course of several issues all of the principal transmitting and receiving apparatus will have been covered. The subject for the first paper is the INDUCTION COIL, that much abused and misunderstood device with which all electrical men are more or less familiar, but which seems to be a complete mystery to the embryo electrician.

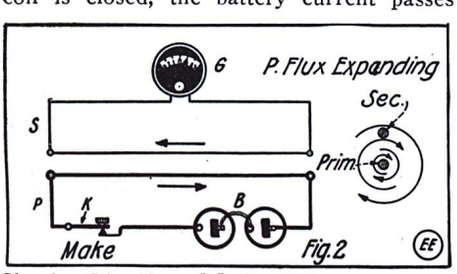
NO. 1—THE INDUCTION COIL.

THE induction coil is in general made up of two distinct windings or coils which are usually arranged one over the other, having an annealed iron wire core passing through their center, as shown in Fig. 1.

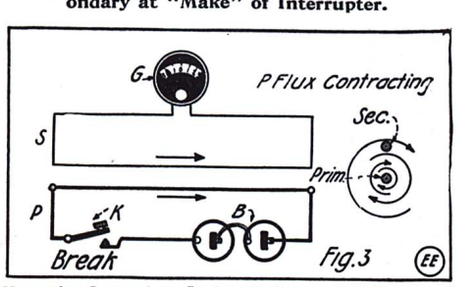
The diagram at Fig. 1 shows in a schematic manner the arrangement of an induction coil designed to produce sparks or high voltages. Usually, at least in wireless work, the primary, or heavy wire winding is placed over the iron wire core. Suitable insulation, consisting of a few layers of insulating cloth or paper, is placed over the iron core preparatory to winding on this coil. After the primary has been completed, which generally consists of two to three layers of comparatively heavy wire, it is carefully insulated by winding over it several layers of insulating cloth; in spark coils above one quarter inch rating it is preferable to place a hard rubber tube over it.

The secondary winding is wound on over this tube, and it is usually somewhat shorter in length than the primary.

Now, when the primary switch of such a coil is closed, the battery current passes



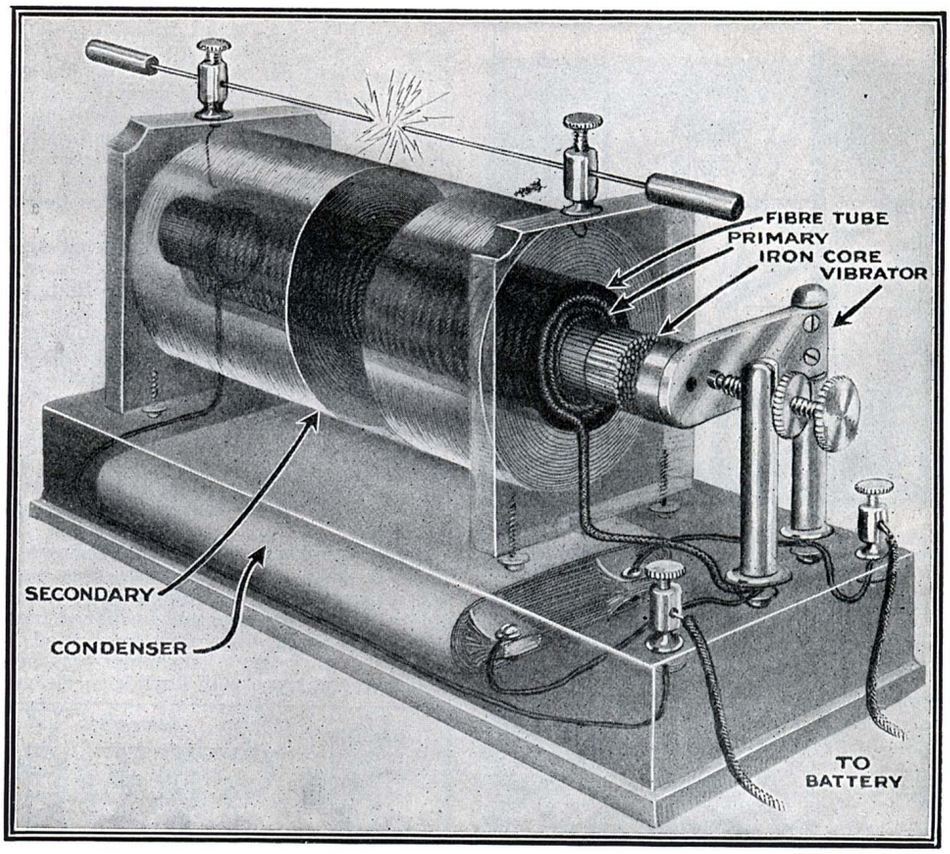
Showing Direction of Induced Current in Secondary at "Make" of Interrupter.



How the Secondary Induced Current is Reversed in Direction at "Break" of Interrupter.

through the first winding on the core and magnetizes it. This attracts the iron armature on the vibrator spring, as shown in Fig. 1, and when this spring breaks contact with the platinum tipped screw in front of it, the circuit is opened. At this juncture there is induced in the secondary winding a very powerful current. The spring-actuated vibrator returns to its former position in the fraction of a second and the process is repeated all over again.

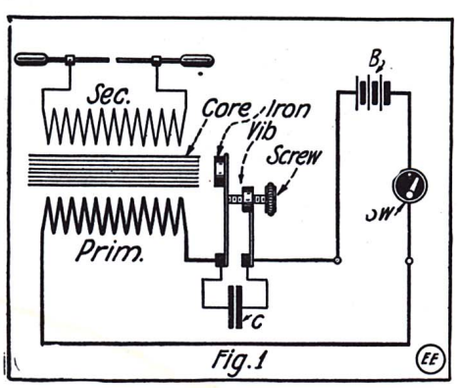
Small induction coils used for medicinal purposes, such as the treatment of rheumatism, etc., are practically never fitted with a condenser across the vibrator. All spark coils, however, are invariably equipped with such a condenser, which reduces the spark at the vibrator contacts and also greatly enhances the intensity of the induced secondary current.



X-Ray View of an Induction Coil, Showing Clearly the Relative Position of the Core Windings, the Vibrator and its Condenser.

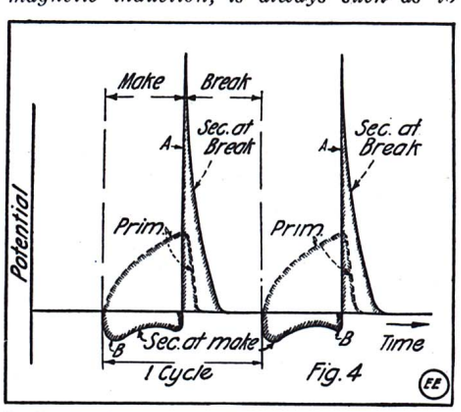
It is generally considered, and is stated in most text-books on this subject, that the voltage of the current induced in the secondary winding will be proportional to the ratio existing between the number of turns of wire in the secondary winding and the number of turns in the primary. This ratio holds true for regular alternating current transformers, but it does not hold exactly true for ordinary induction coils, as the potential of the secondary induced current is, to a great extent, proportional to the speed of the vibrator interruptions.

We may examine the phenomenon taking place at both the *make* and *break* of the



Circuits of "Spark" Coil, Which Always Have a Condenser Across the Interrupter as Shown.

spark coil vibrator, by referring to Figs. 2 and 3. As will be evident from Fig. 2, the direction of the induced current in the secondary is opposite to the direction of the primary current, during the *make* period at the vibrator. This is in accordance with the law of Lenz, which states *that the direction of a current produced by electromagnetic induction, is always such as to cause it to oppose the motion by which such currents were produced.* The half wave of secondary current induced at *make* is not of very high value, and is termed the *inverse current.* The phenomenon taking place at the *break* of the primary circuit vibrator or interrupter is exhibited at Fig. 3. Here the secondary current passes in the same direction as the primary current. It is, moreover, of very high instantaneous value and possesses much greater energy than the inverse half wave B, shown graphically in Fig. 4.



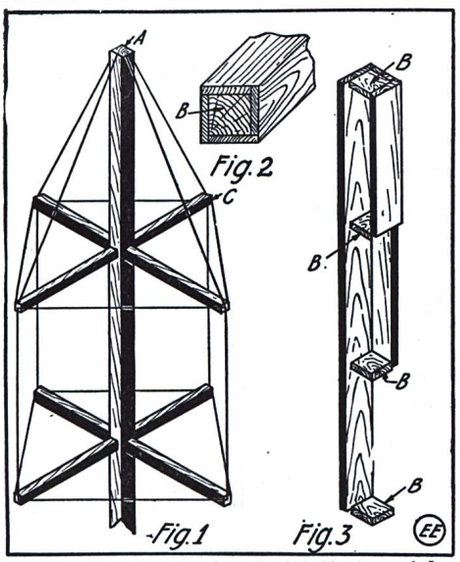
Oscillograph Curves of Primary and Secondary Currents at "Make" and "Break" of Primary Interrupter of Two-inch "Spark" Coil.

This may seem at first quite contradictory to the statement of Lenz's law, but up-

(*Continued on page 523*)

CONSTRUCTION OF A REINFORCED WOOD MAST.

To the amateur desiring to raise his aerial to a greater height than his present single stick mast will permit, the following construction of a reinforced mast or tower is



A Good Idea for Bracing Aerial Masts and Inexpensive to Apply.

offered. It may be built to any reasonable height and can be extended to a greater height at any time the amateur chooses.

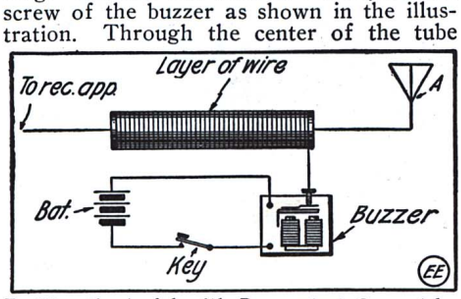
The mast A (Fig. 1) is composed of two strips of wood ½"x3"x12" nailed together as shown in Fig. 2, forming a hollow box with the exception of blocks B (Figs. 2 and 3) placed every three feet within the mast to keep it square. In starting the construction of the mast, boards of the above dimensions, three feet, six feet and nine feet long are nailed together as shown in Fig. 3, and the construction continued with twelve-foot boards until the mast is of the desired length. It is then finished with shorter pieces as above. This brings a single joint at each three feet of the mast.

The braces C (Fig. 1) are one inch square by one and one-half feet long and may be either solid or of box construction. Four are nailed to the mast every three feet and wired as shown in the diagram with doubled iron wires which are twisted until tight. The wires are attached to the ends of the braces with nails or screw-eyes. The entire tower should be given a coat of white lead paint for a neat appearance and to prevent the wires from rusting. It should be guyed by at least three guy wires spaced 120 degrees apart.

Contributed by H. W. OFFINS.

INDUCTIVE BUZZER TEST FOR DETECTOR.

Wind a layer of wire around a cardboard tube about 1 inch in diameter and 3 inches long. Connect the wire to the adjustment screw of the buzzer as shown in the illustration. Through the center of the tube



Exciting the Aerial with Buzzer-test Current by Induction from a Coil as Shown.

run the wire from the aerial. The buzzer signal will be heard in the receiver distinctly and loudly if the detector is adjusted correctly.

Contributed by ALFRED O'HARA.

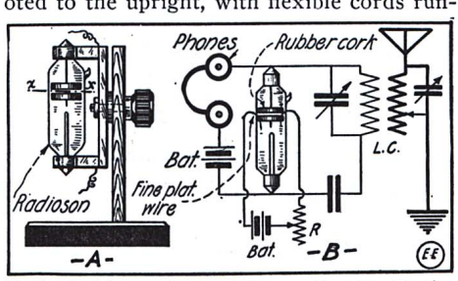
EXPERIMENTS WITH A RADIOSON DETECTOR.

The latest type of sealed point detector, termed by its makers the *Radioson,* has been the subject of very little experimenting. This detector works very well and is unusually sensitive, yet too many amateurs fail to realize the broad field of research opened to them by this instrument. They merely mount it on their receiving set, marvel at its efficiency and naturally do not try to improve its operation, thinking it perfect. The author recently conducted a series of experiments that rendered the instrument even more sensitive and may be of interest to owners of similar detectors.

These experiments were conducted on a cartridge that had been in use for a year. The first noticeable detail of the Radioson was the fact that it was impossible to get at the sealed-in platinum point and steps were taken to render this possible. Referring to Fig. A, the glass was carefully filed at the point X, and a light tap served to part the glass tube.

The next step was to obtain a rubber cork, drill a hole through it to pass the upper electrode, and by using this cork as a coupling the entire cartridge was re-assembled.

A new stand was constructed as shown in Fig. A base of suitable size was used and an upright was mounted thereon. A holder for the cartridge was fashioned from a strip of wood; two clips were used to clamp the cartridge. The holder was pivoted to the upright, with flexible cords run-



Method of Mounting and Connecting the Radioson Detector for Improved Results.

ning to the clips. The sketch shows the device very clearly and will facilitate the construction.

With this device it was possible to place the cartridge at any angle desired. With the detector in the circuit and signals coming in, the knob was slowly turned; the signal strength does not change at once but when it reaches a certain point the intensity of the signals suddenly increase to an almost unimaginable extent.

The writer has since determined that this angle varies with different cartridges, no doubt due to slight irregularities in the glass around the sealed-in point. The action may be due to some capillary action between the glass and the hydrogen gas, since bubbles do not come off as frequently as before. With such an arrangement it is possible to tune out weak interfering stations by merely turning the knob to the proper position.

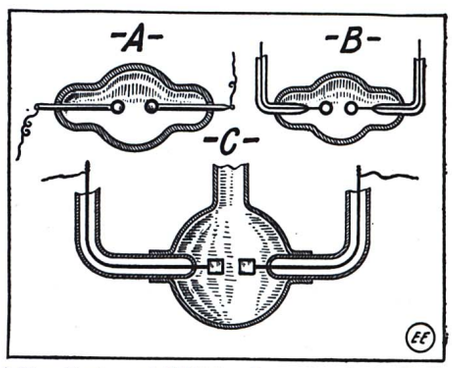
The final experiment was to provide for some means of agitating the liquid. To do this, short lengths of platinum wire were forced through holes in the cork as shown in Fig. B, flexible cords being attached to the protruding ends. The circuit used is also given for the benefit of those not acquainted with this little "kink." The extending seal of the cartridge was broken off to allow any gas formed to escape.

The results with a common Radioson may be excellent, but the signals obtained with these improvements are astounding. With a 65 foot aerial, 55 feet high, eight wires, loose coupler, variables, 2,000 ohm 'phones, NAR and NAX come in loud and clear. I heard an amateur in Michigan with a 1 K.W. set; everything on the coast "drums in" at night.

Contributed by FRANK M. KUSS.

LONG SPARKS AND QUENCHING TUBES.

Max Wein has shown that quenched spark excitation can be affected by aid of long sparks, if the coupling between the



A New System of Utilizing Long Sparks in Radio Involves Passing Them Thru Quenching Tubes.

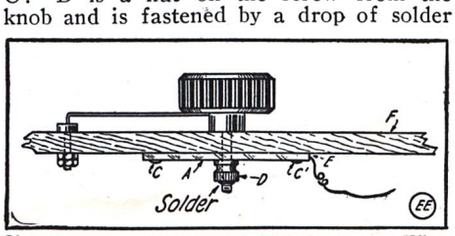
primary and secondary circuits is nicely adjusted, states Dr. Eccles in his work, *Wireless Telegraphy and Telephony Hand-book.* Sparks between 0.5 and 2.0 cm. can be used; silver electrodes are best, magnesium worst, as regards the effective value of the secondary oscillations. But the coupling has to be loose, and therefore the building-up period is about as long as the decay period, with impure oscillations as a result. These defects may be partially removed by multiple gaps and immersion in hydrogen, but the use of quenching tubes is much superior.

A quenching tube is merely a short (evacuated) Geissler tube. Several types are shown in the illustration. The best pressure is between 0.1 and 1 mm. of mercury, and hydrogen gives rather better quenching than air. The best metal for the electrodes is silver. The tube is placed in the primary circuit, near the ordinary spark gap. With a primary circuit, comprising a condenser of 0.86×10^3 M. F. and an inductance of 40,000 e.m., together with a nearly equal secondary circuit, the critical coupling was about 10 per cent. Capacity change has little effect on efficiency, which is high. Thus with a spark gap of 2.5 cm., between silver discs 5-cm. diameter and a quenching tube with silver electrodes, an efficiency of 84 per cent was reached, the secondary R.M.S. current being 4.4 amperes. Wien has shown that this method of shock excitation can be easily and effectively carried out with power inputs of about 1 K.W.

USEFUL SWITCH WRINKLE.

Here is a plan for fastening wire to switches on loose couplers that I have found convenient.

F is the panel. A is a brass or copper plate fastened to panel by screws C and C'. D is a nut on the screw from the knob and is fastened by a drop of solder



Simple Design of Cabinet Switch Having no Wires to Work Loose.

so that it cannot work loose. The wire connection is soldered on the plate at some corner as at E. This way there is no strain on the wire and the switch will never work loose.

Contributed by HOWARD BIERLY.

Radiation Current In Radio Antennae

By C. L. Whitney

Many amateurs have often been puzzled over this question: "How many watts do I radiate?" Of course we know that we cannot take the approximate voltage (in the aerial) and the amperage, and multiply to get the watts; for example: We have say, 10,000 volts at the antenna lead, and our hot-wire ammeter reads 5 amperes. Now if we calculate the watts by the ordinary method we would have 50,000 watts or 50 kilowatts, which we know cannot be correct as we only have a 1 K.W. transmitting set. We can never get over 100% efficiency, while if we did get 50 K.W. in the aerial, we would be getting 5000% efficiency, or the aerial current would be 50 times as much as we draw in the transformer.

Many of us have not been able to figure out, even approximately, what our radiation really is, and the author hopes that the following formulae will prove of value:

The watts radiated from a flat-top aerial may be found from the equation:

$$P = 1578.2 \frac{h^2}{\lambda^2} a^2$$

Where:—P=power radiated in watts.
h=height of aerial (in feet).
λ=length of emitted wave (in feet)
a=amperes, as measured by hot-wire ammeter in aerial circuit.

This formula is used where the antenna capacity is mostly in the flat-top. For example:

Supposing we have a flat-top aerial 100 feet high with leads brought down from the center. Our wave-length is, say, 600 meters or approximately 2,000 feet. The hot-wire ammeter reads 5 amperes.

$$\text{Then:—} P = 1578.2 \left(\frac{100^2}{2000^2} 5^2 \right)$$

$$\text{or } P = 1578.2 \frac{10{,}000}{4{,}000{,}000} 25 = 88.6375 \text{ watts.}$$

Therefore, with a flat-top aerial 100 feet high on 600 meter wave-length we are radiating approximately 88 watts.

The watts radiated from a vertical aerial is given by the formula:

$$P = 640 \frac{h^2}{\lambda^2} a^2$$

This formula is applied in the same way as the first.

Now we can calculate the power radiated in still another way, as long as we know the radiation resistance of the aerial, and the number of amperes.

$P = Ra\ A^2$

Where;—Ra=radiation resistance in ohms.
A=Amperes, measured by hot-wire ammeter in ground or aerial lead.

To find the approximate radiation resistance (Ra) of a flat-top aerial we use this formula:

$$1600 \frac{h^2}{\lambda^2} = Ra \text{ (in ohms)}$$

Where:—h=height of aerial (in feet)
λ=length of emitted wave (in feet).

Now compare your transformer input (in watts) with your aerial radiation, (in watts), and you will see that radio apparatus is not so efficient as many have been led to believe. As mentioned before, we have a 1 K.W. set which radiates 5 amperes in the aerial (which is 100 feet high). 1 K.W.=1,000 watts. (This is the transformer input.)

According to our calculations the radiation is 88.6 watts. It is easily seen that the set is only 8.8% efficient (from power input to aerial). If we improved our station in some way, other than by raising the transformer input, and we obtained 6 amperes instead of 5, we would radiate 142 plus watts; our set would then be nearly 15% efficient.

We can increase the radiated power by increasing the height of the aerial. Thus if our aerial was 200 feet high instead of 100 feet and the hot-wire ammeter reading remained the same (5 amperes) we would radiate 4 times as much as before or about 375 watts.

Radiation may also be increased by increasing the number of wires in the flat-top, but the most effective way to increase the radiation (and incidently the range of the station) is to increase the height of the aerial. We could build an aerial say 100 feet long, at a distance of about 10 feet from the ground, and when we connect our transmitting set to this, the hot-wire ammeter will show a higher reading than when the set was connected to a high aerial. However, by the above formulae we can readily see that the power radiated (watts; not amperes alone) is not high, and naturally the distance we can transmit is also curtailed very much.

It is now plain why in some cases one station (call this station No. 1) radiates say, 8 amperes, and has a range of say, 200 miles; while another station (call this station No. 2) radiates say, 5 amperes and works 300 miles as easily as station No. 1 works 200. If you will notice carefully just how each station's aerial is built and how the leads run (if parallel to iron masts, stacks, etc., in case of a station on a ship) you will find that the aerial of station No. 1 is either low, or that the leads run parallel to some grounded object and therefore although 8 amperes leaves the station, much of it is lost to the grounded objects. Again the aerial may be low and thus the WATTS radiated is low, although the hot-wire ammeter shows a high reading. The practice of using hot-wire ammeter readings to compare two or more stations is very misleading, as becomes apparent.

The author has tested a United-Marconi 1 K.W. set which was practically 15% efficient (from transformer input to aerial), radiating about 150 watts in the aerial, and with which it was possible to work from 400 to 500 miles in the daytime with the sun shining, although the aerial was only about 90 feet above the water. This set was installed on an Army Transport which took part in the operations during the 1914 Mexican trouble.

A HINT FOR COPYING N A A WEATHER REPORTS.

In connection with copying N A A Weather Reports I have memorized the following signs which aid greatly in taking the reports down, especially when they are sent fast. After trying them out a few nights, I found it very easy to get the reports complete, as these are a form of shorthand for the more commonly used words in the reports. Here they are:

North ^	East >	From c
Northeast ^1	West <	To '
Northwest 1^	Moderate /	And –
South v	Winds \	Great Lakes ɔ
Southeast v1	Atlantic I	Pacific II
Southwest 1v		Coast o

These words occur most frequently in every report, for instance:

^1 \ c ɔ
Northeast winds from Great Lakes at 30
o
miles an hour to Florida coast.

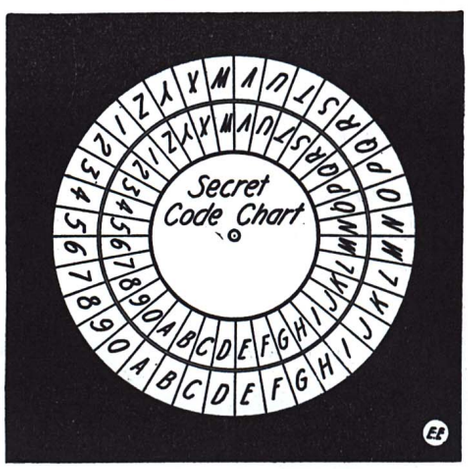
After a few days practice it comes easier than to write them down.

Contributed by FRANK TALONE.

A "SECRET" CODE CHART.

Now that there are so many amateurs in the wireless field, it is often found very convenient to use a secret code for any communication which it is desired to keep more or less private.

The following described "secret" code chart has the great advantage of containing many different combinations which may be easily deciphered.



To Operate This Secret Code Chart, Rotate the Inner Disc Until the Desired Letter Is Opposite the Letter on the Outer Disc to Be Sent by Code

Two circular disks are cut from cardboard, one about 1¼ inches less in diameter than the other. The circumference of each is then divided into 36 equal parts and radial lines are drawn through these points. Holes are then cut through the centers of the disks and the disks put together and fastened loosely, with an "easy rivet," so that the disks may be rotated independently.

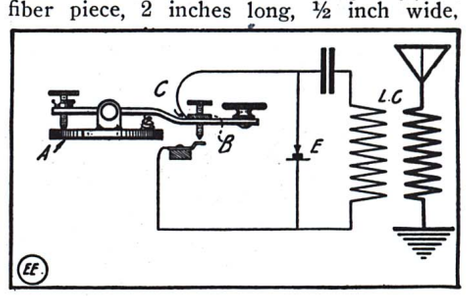
Letters are marked on the circumference of the disks in the spaces, as indicated in the accompanying illustration.

To use: Rotate the inner disk to the combination desired. Then send the letter on the *outer* disk, opposite the letter which forms the word on the *inner* disk. This gives the combination. Then substitute the letters on the outer disk for the adjacent letters on the inner disk. Each card gives 36 different combinations. Various cards may be made with the letters in different sequence.

Contributed by
RAYMOND S. SUTCLIFFE.

SIMPLE DETECTOR SHUNT.

Many amateurs are bothered by the detector being knocked out while sending. This is very annoying and can be remedied by this device. Referring to the illustration, A, represents the sending key; B, fiber piece, 2 inches long, ½ inch wide,



Auxiliary Contact Arranged on Key to "Shunt" Radio Detector While Transmitting a Message

drilled with 2 holes as observed; C, contact screw from old key; a bottom contact mounted on fiber block; E, detector. This device short-circuits the detector during sending.

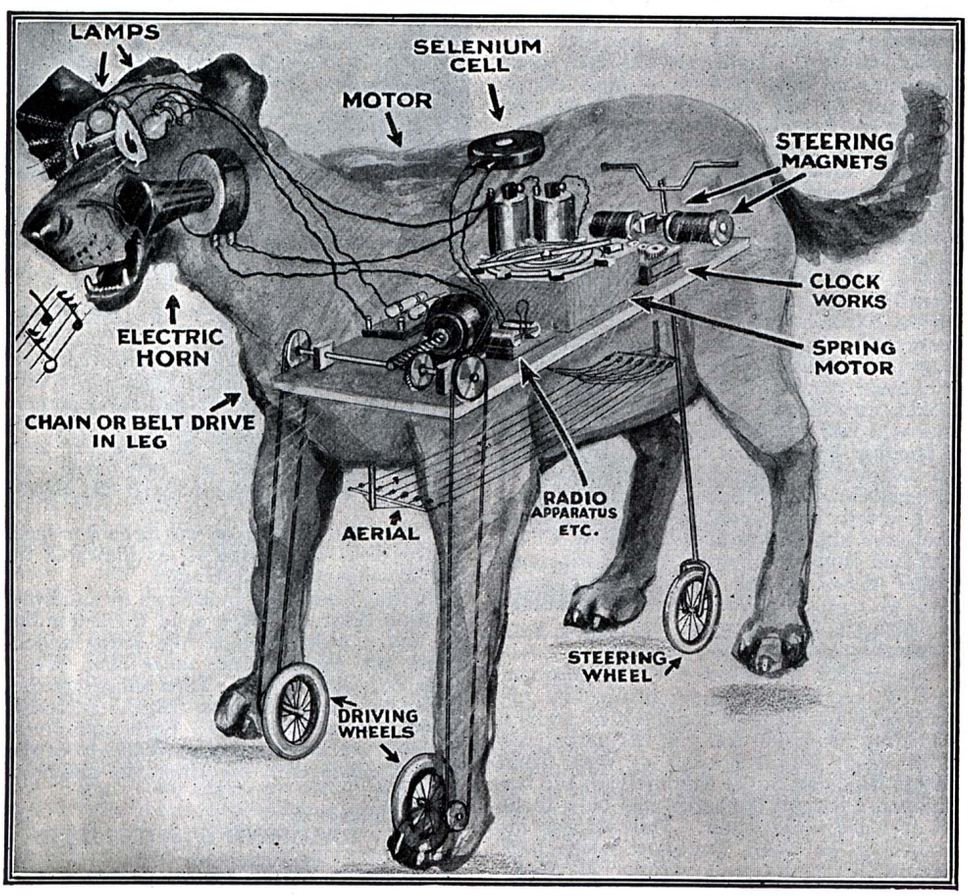
Contributed by
WARNER N. CROSBY.

THE CONSTRUCTOR

A Wireless "Hound" That Dogs Your Foot-Steps

By F. A. Steinbrook

HOW would you like to have an electric "pup" that will follow you around like all faithful quadrupeds of the genus "hunt." Well, here's how:



Here we Have the Experimenters' Delight—a Wireless "Hound" That Will Obey Your Most Ardent Desires. It Can Be Operated by a Flash-light Ray Thrown on a Selenium Cell or by Wireless Waves Actuating a Coherer and Relay.

To make this faithful "canine" we will first require a selenium cell, 2. It is placed on top of the electric dog, so it becomes easy to focus light rays on it at any desired time. When rays of light are focused on the selenium cell, making it a conductor of electricity, it closes the circuit to the polarized relay, 3. In turn, this relay closes the circuit to the selective device, 1. A two point switch, 4, is placed in the circuit; when the switch blade is placed on point No. 1, the selenium cell is in circuit; when placed on point No. 2, the coherer is in circuit. (The selective device was made from a phonograph works.)

The polarized relay 3, closes the circuit to the magnet 12, on the selective device, which releases the rotator, 22, allowing it to rotate to the right as long as the circuit is closed. There are six stops on the selective device. When the circuit to the selective device is opened, by removing the light rays from the selenium cell, the magnet, 12, releases and the rotator stops at one of the six selections. When the rotator is halted at stop, 6, this is the neutral position. If the light rays are flashed on the selenium cell and immediately released, the rotator turns to stop 1; the pressure of the rotator against stop, 1, closes a circuit and starts the motor, 5. This in turn starts the dog in a forward direction. (The driving arrangement is shown quite fully in the drawing.)

When the rotator is in this position, it makes another contact with the contact rings, 11; this also closes the circuit to the motor, and the motor is kept in circuit until the rotator reaches stop 5. Then the circuit to the motor is opened, when his riverence, the "pup," stops his forward peregrinations.

A second flash of the light rays on the selenium cell, and the rotator moves again and halts at stop, 2, closing the circuit to the solenoid, 9; this turns the wheel, 21, to the left, and the dog moves in the same direction.

A third flash of the light rays on the cell and the rotator moves to stop, 3, closing the circuit to the solenoid, 8. This has the effect of turning the dog to the right.

A fourth flash and the rotator moves to stop, 4, closing a circuit to the electrical horn, 10, adjusted to give a growling note as if it wanted more frankfurters.

A fifth flash and the rotator moves to stop, 5, closing a circuit to the automatic flasher, 7. This flasher opens and closes the circuit to the electric lights, 19, or "eyes" of the dog, causing them to flash on and off. This continues until the sixth flash of the light, when the "dog" becomes perfectly neutral. (The flasher, 7, can be made from the striking part of an old clock.)

A pointer connected to the rotator by a rod, may extend to the top of the dog's carcase. Numbers from 1 to 6 are placed on top of the dog, corresponding with the respective positions of the selector.

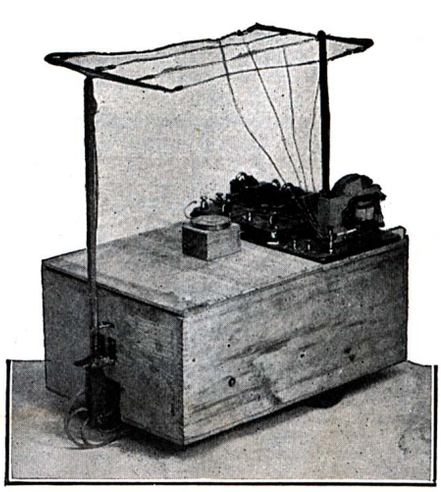
When the selective device is at point, 4, the pointer on top of the dog is at 4, etc. This enables the dog's master to determine exactly where the rotator is at any time, and to aid in the selecting.

By flashing the light rays on the selenium cell, one may watch the pointer and select any of the desired stops. If it is desired to have the dog to go to the right, the light rays must be flashed on the cell until the pointer is at index, 3. The rotator may be stopped at point 1, then at point 3, or 4, as desired.

When the dog is to be controlled wirelessly, the switch, 4, is turned to point, 2. This places the coherer in circuit with the polarized relay, 3.

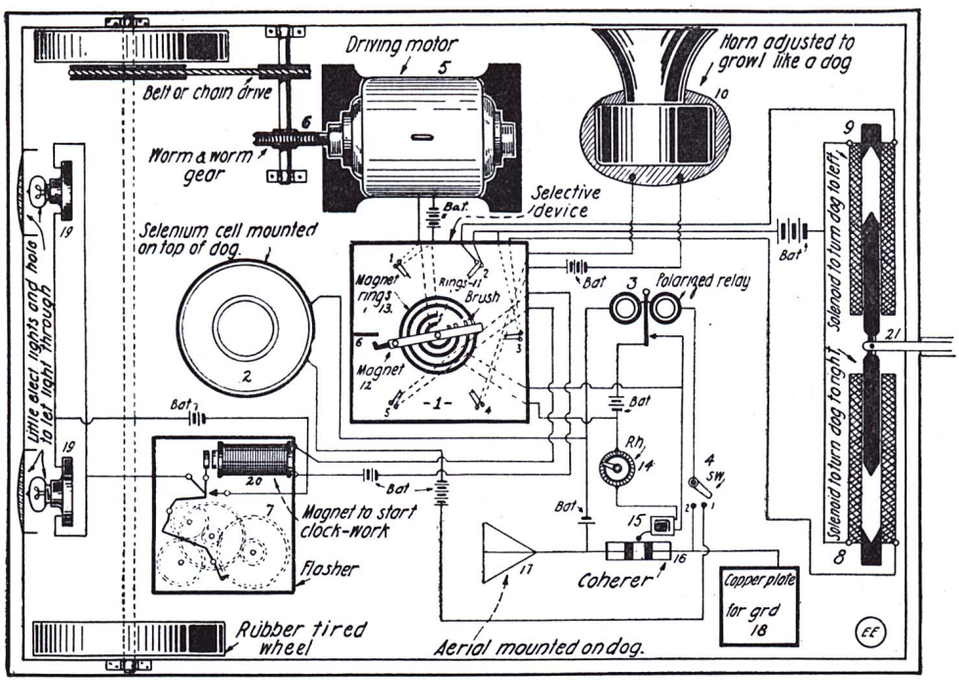
A small aerial is placed on top of the dog, and a copper plate on the side serves as a *capacity* ground. By using an ordinary radio sending set, selections may be readily made; each time the key of the sending outfit is depressed the selective device works in the same manner as with the use of the selenium cell and flashlight.

To make a real "dog-gone hound" out of this all-fired contraption one should procure some papier-maché and build up a



A "Mongrel" Wireless Pup which may Have his Works Encased in a Common Soap Box.

carcase on a wooden frame. The legs, head and tail can be easily formed in a rough manner of light sticks, well nailed and screwed. The legs do not move. Locomotion is effected through the two chain or belt-driven rubber-tired wheels on the front feet. The animal is steered about by the electro-magnetically controlled rear



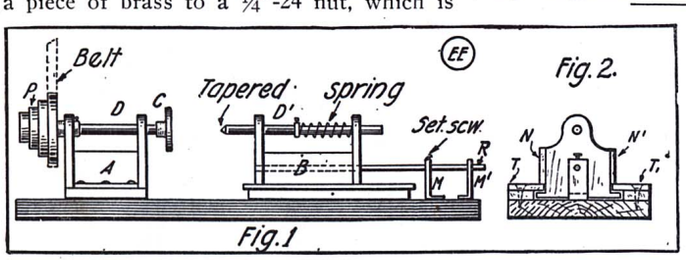
Wiring Diagram for Wireless "Hound," Showing Relation of Propelling Motor, Radio Apparatus, Selenium Cell, Steering Mechanism, Eye Lamps and Flasher and "Growl" Producer.

wheel, which should be painted and constructed to be as inconspicuous as possible. A crude electric dog is readily made from a soap-box and three wheels as shown in one of the illustrations herewith. The wooden frame of the dog may be covered with a mixture of shellac and paper, with a little care. Paper pulp works best for this purpose.

A SMALL WINDING LATHE.

Every experimenter wishes a small lathe to turn pulleys or wheels out of wood or to wind magnet coils. One that can be run from a small emery wheel motor or even a sewing machine, can be made from two old magneto frames such as used in telephones.

In Fig. 1, A is magneto frame with the armature removed; B is a second frame with rod R in place of armature and soldered or screwed to frame B. Rod R passes through two standards M M', with set screw in M to hold tail piece of B in position. The face plate C can be made by soldering a piece of brass to a ¼"-24 nut, which is



Simple Winding Lathe Constructed from Two Magneto Frames, Assuring the Builder of Having Good Bearings at Least.

usually the thread of the shaft D. Shaft D' has the large gear cut off and the shaft is tapered to a point. On this shaft is a spring with collar and set screw.

Fig. 2 shows clearly the end view of B. TT are two pieces of flat iron to form a track. NN are two pieces of iron screwed on the sides of the magneto frame to form a slide.

When pulleys are turned the wood can be screwed to the face plate. The triple step pulley P was turned that way. When winding coils the core can sometimes be held by inserting a piece of rubber between face plate and core. The spring on shaft D tends to take up any lost motion.

Contributed by ARTHUR A. REEVE.

INVISIBLE PHOTOGRAPHS.

In time of war particularly, when certain information should be rigorously kept secret, even from subordinates in the same service, it may be useful for government officials, military commanders and others to have a method of keeping copies of plans, documents, photographs, etc., in their possession in such a manner that they are ordinarily invisible, but can be revealed by a simple process when required.

After trying numerous printing-papers and bleaching-baths, a writer in *Progresso Fotografico* has come to the conclusion that the least visible image is given by the thin sepia paper of commerce. It is exposed rapidly to direct light, developed in ordinary water, then treated with a 2-per cent. hyposulphite solution, and washed for a few minutes. The images obtained are not very rich in half-tones, but this is not of great importance for practical purposes. When the prints are placed in a solution containing, per liter, 10 grams of copper sulphate, 20 grams of potassium bromide, and 5 drops of hydrochloric acid, the image disappears instantly, and, after washing, one may dry the print, upon which nothing is visible. If the precaution is taken to plunge the print in a weak bath of potassium bromide, even exposure to light does not cause any reappearance of the image.

CELLULOID VARNISH.

For coating high frequency apparatus, varnishing loose coupler tubes and coils, mending broken celluloid articles, making enamel wire, or lacquering exposed metal parts of receiving apparatus, celluloid varnish is just the thing. It is easily made, and the great advantage of this varnish is that it has a very high insulating property, and when properly prepared, has a glossy finish, on coils for instance, that quite resembles glass. Another good point: it is moisture-proof, flexible and dries very quickly, an important factor. In short, it is a very useful and handy preparation in any laboratory or experimental workshop.

Formula.

1st.—Procure a quantity of film trimmings, which any obliging photographer will let you have.

2d.—Remove gelatine coating on film trimmings by washing them in hot water to which soap may be added.

3d.—When dry, dissolve films in the following solution:

Acetone, 2 oz.
Amyl Acetate, 2 oz.

Add the film trimmings until you have the right constituency to suit the work.

Contributed by
ARTHUR PELLETIER.

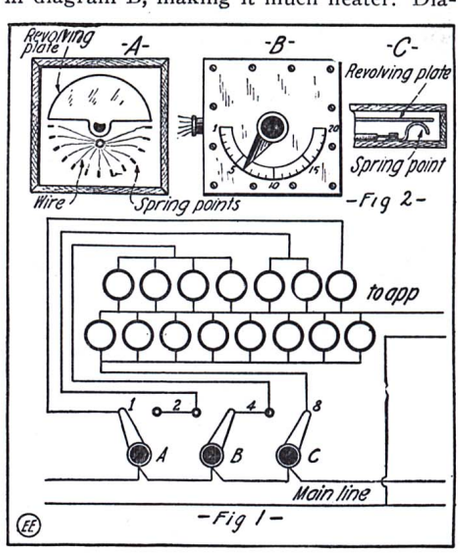
LAMP BANK SWITCHES.

A wiring diagram is shown at Fig. 1, by which the number of lamps connected in multiple in a lamp-bank is changed in uniform steps by means of a very simple switch-board. It may also be used to change the number of plates in a "fixed" condenser. By manipulating the switches A, B and C, the capacities, of which there are four, each in successive step twice the one before it (i. e., if the first is—one, the next—two, the third—four, and so on) can either be taken separately or added, so that fourteen capacities are obtained in steps equal to the first capacity value. The *points* on the switch-board are marked with their capacities as shown and thus it is a very simple matter to obtain the desired capacity.

(By connecting a single point switch, extra, to capacity No. 1, it can also be added to the sum total of all.)

Diagram No. 2, is a multi-point switch, by which the number of lamps or other apparatus, connected in multiple, is changed by simply turning a knurled knob. Each lamp is connected by one pole to a spring contact point, which is connected in succession to the others by the copper plate shown in diagram A, which is revolved over them by means of the knob.

It may be placed behind a panel as shown in diagram B, making it much neater. Diagram C, shows a spring contact point in detail. These should be mounted as nearly in the same plane as possible and should be of moderate strength only.

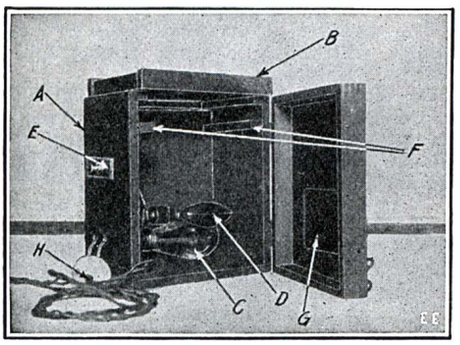


Effective Switching Arrangements for Lamp Banks, Permitting Any Number of Lamps to Be Connected in Parallel as Desired.

Contributed by JESSE O. HOWELL.

DARK ROOM LAMP AND PRINTING BOX.

Referring to the illustration herewith, A is a wooden box 8 by 7½ by 5¼ inches, outside dimensions; B is a printing frame (postcard size) screwed to the box over hole cut in box which corresponds in size to the opening in printing frame; C is a



An Amateur Dark-Room Lamp and Printing Cabinet of Small Cost. Contains Red and White Bulbs.

25-watt Tungsten lamp in socket; D is a 5-candlepower red bulb in a candelabra socket; E is a push switch off an automobile dash; F are blocks to hold a ground glass 4¾ by 6½ inches; G is the opening in front fitted with a yellow and a red glass, the latter being removable, while H is a cord and wall plug.

This outfit was made of material which I had around the house and gives the same results as a $7.50 outfit purchased from a dealer.

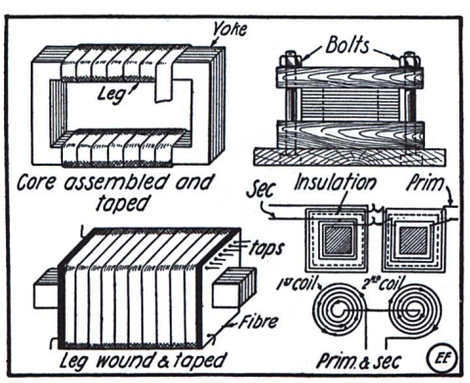
Contributed by A. E. WILSON.

A 30 VOLT LABORATORY STEP-DOWN TRANSFORMER.

This transformer operates on 60 cycle, 110 volts A.C. and gives from 3 to 30 volts in 3 volt steps. It is very suitable for use in a home laboratory.

The core is in the shape of a hollow rectangle, 6¼ inches by 4¼ inches outside dimensions, being composed of pieces of transformer iron, 1¼ inches by 5 inches and 1¼ inches by 3 inches, stacked in the usual way so as to make the core 1¼ inches thick when compressed. This will require the purchase of a piece of "stove pipe iron" 2 feet wide and 4½ feet long. After being stacked the legs of the core are taped with three layers of insulating tape and then the yoke pieces are pulled out, leaving the legs intact.

Four fiber heads are made 2¾ inches square, with a 1¼ inch square hole in the



Details and Hook-Up for Small Step-Down Transformer of Closed Core Type.

center. These are slipped over the ends of the legs.

The low voltage secondary is wound first. This consists of 240 turns of No. 14 D.C.C. wire, *120 turns on each leg.* This will require about two pounds of wire. Taps may be taken out as often as desired, depending upon the range of voltage wanted. In this case they were taken out every twenty-four turns, giving 3 volt steps. The taps are soldered and taped to the winding and the wire is run back over the winding to holes in the fiber heads. Each layer of wire should be shellacked.

Between the secondary and primary a layer of tape and several layers of shellacked paper are placed.

The primary (110 volt A.C. winding) should consist of 900 turns of No. 24 S.C.C. wire, 450 turns on each leg. This will require about one pound of wire. The wire should be wound very smoothly and evenly, and each layer should be separated by a layer of shellacked paper. Be sure to wind the two legs in the same direction.

Outside the last layer of wire on each leg place a layer of tape and shellac well.

The yoke pieces of the core should now be fitted into place. Place one piece between the laminations of the other leg and so on until all the spaces are filled. The windings should now be connected, the parts of each winding on the two legs being connected in series as shown in the drawing.

A good mounting for the transformer is shown in the drawing. The windings are left out for the sake of clearness. The taps from the secondary may either be connected to binding posts or some sort of switch, as the experimenter may elect.

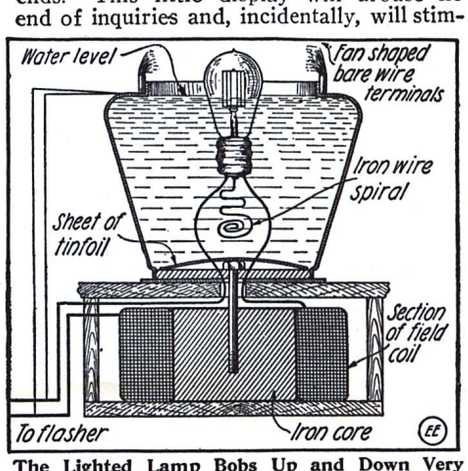
Contributed by ADRIAN SCHADE.

UNIQUE ELECTRICAL WINDOW ATTRACTION.

As everyone knows, the moving window attraction draws more of a crowd than any stationary display of goods, and if this attraction has the element of mystery in it the crowd will be larger. The *Electrical Review* gives the construction of one of these attractions, which is especially good for an electrical shop or booth. It consists of an opal arc-lamp globe practically full of water in which an incandescent lamp floats "tip up." At short intervals the lamp lights up brilliantly and at the same time disappears or ducks under the water in a very mysterious way. After a few seconds it again bobs up and its light practically fades out. This is repeated indefinitely. The only apparent, though misleading, explanation seems to lie in some wires with bared ends projecting over the edge of the globe, thus giving the idea that the action of the lamp was due to wireless or inductive influence.

The accompanying illustration will give the details so that anyone interested can construct one. A field coil from an old dismantled motor is placed in a box and within is put an iron core; a small iron pulley that happened to fit the coil was used for this one. An iron bolt is put through the box cover into the center of the core and the wires feeding the lamp run through the cover alongside the bolt. The lamp is connected in series with the coil; the wires are soldered to the lamp base and well protected by rubber tape. To seal the bottom of the globe use a rubber sheet with a layer of sealing compound filled in; an electric soldering iron is used to work the compound well around the edge and about the bolt head to make a water-tight seal. Fasten an iron wire with the lower part in a spiral form to the lamp base by a loop over the tape. This wire is of just the right weight to keep the lamp about half submerged when the current is off. Connect into the circuit a Thermo-blink flasher, which periodically cuts the current in the lamp and coil circuit down to a low value. As the current is restored to full value the coil is energized and the iron spiral with the attached lamp is pulled down toward the bolt head. A sheet of tinfoil over the latter prevents actual magnetic contact and sticking due to residual magnetism when the current is again cut down to its low value.

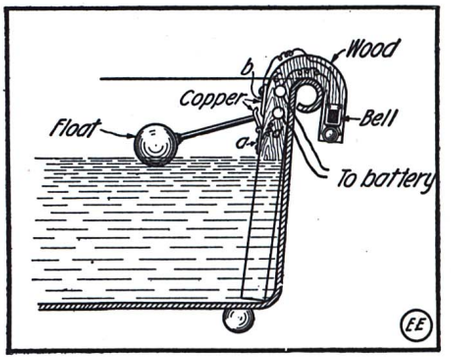
The cabinet on which the globe is placed and the wires really leading to the coil and lamp are covered by a cloth, leaving very conspicuous, however, the wires on the outside of the globe to the antenna-like ends. This little display will arouse no end of inquiries and, incidentally, will stimulate the sales of all kinds of electrical goods, which, of course, is its prime object. Moreover, it is a novelty that will appeal to parlor entertainers and rising young Edisons who want to impress their doting parents with their marvelous genius.



The Lighted Lamp Bobs Up and Down Very Mysteriously, Due to Action of the Electromagnet.

A BATH TUB ALARM.

The hook at the top of the cane-shaped wooden strip is hung over the side of the bath tub and the water turned on. The float is made in such a manner that when the water rises as high as the float the water will lift the float up until contact A touches contact B, thereby closing the cir-



Removable Home-Made Electric Alarm for Bath Tubs. Rising Float Closes Bell Circuit.

cuit and ringing the bell. Of course a battery is connected to the two binding posts C and D. These posts may be placed in a convenient position on the wood strip.

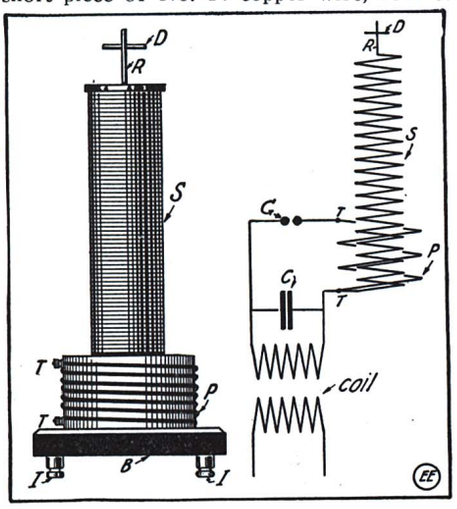
This piece of apparatus is intended to give an alarm when the water in the bath tub attains a certain height. For instance, suppose Mr. Jones wants to take a bath and also a shave. He puts the bath tub alarm in place and connects up the battery; then he turns on the water. He goes into another room and starts to shave. While he is shaving he hears the bell on the alarm ring, thereby notifying him that the tub is full. He can then turn the water off and keep the tub from overflowing.

Contributed by PHILIP MANDELBERG.

To polish woodwork: Apply several coats of varnish, rubbing down each coat with linseed oil and powdered pumice stone.

HIGH-FREQUENCY RESONATOR FOR SPARK COILS.

Procure a mailing tube S 9 inches long by 2 inches in diameter and wind with No. 34 wire leaving ½ inch space at the top and bottom. Next take a straight, short piece of No. 14 copper wire, filed to



An Oudin High Frequency Coil for Use on Small Spark Coils. Many Interesting Experiments Can Be Performed with This Apparatus That Open Up a New Field to the Amateur.

a point. The disc D is of thin aluminum and about 1 inch in diameter. In the center of this punch a hole so that the wire R may be pushed through it. A disc of thin fiber or heavy cardboard is glued to the top of the tube. A hole is punched in it so that the wire bearing the disc may be pushed ½ inch through it, that is down into the tube. One end of the No. 34 wire is soldered to the No. 14 wire. This completes the secondary.

The primary is of Empire paper or heavy cardboard 2½ inches wide and 3 inches in diameter. The primary winding P consists of eight turns of No. 14 stranded rubber-covered wire, the ends of which are fastened to two battery binding posts T T.

The primary is then glued to a small wooden base B. The bottom end of the secondary wire is soldered to the bottom primary post so that the windings are in the same direction. The last thing to do is to glue, *not nail or screw,* four standard porcelain insulators on the base.

The whole should be constructed without screw or nails, and if made carefully it will give remarkable results.

This resonator may be worked on any coil up to a 3-inch size, though it is rather too small for a ¼ k.w. transformer.

Before winding the tubes both should be boiled in paraffine.

Contributed by F. K. BILLAU.

PRODUCING CHLORINE ELECTRICALLY FOR LAUNDRIES.

A new field has been recently developed to some extent in the application of electricity to the washing of soiled clothes. This involves a process making use of chlorine, to be used as a substitute for the bleaching compounds commonly used for this purpose; and owing to the fact that this has been largely imported from abroad it has become quite out of reach for ordinary requirements.

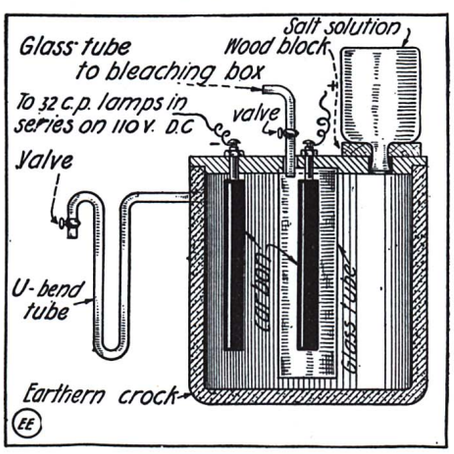
An easily made device for the electrolytic production of chlorine is described in the *Electrical World* by Mr. H. P. Hill. One of the smaller apparatus suitable for home use is described herewith.

Referring to the accompanying sketch the various parts of the device for electrolytically producing chlorine are indicated as follows:

In this type the apparatus is automatic and the current automatically cuts itself off when a supply of chlorine is made. The outfit can be adjusted to feed as little gas as required, the supply and discharge being regulated by the gas pressure in the generator. The bottle, usually 1 gal. in size, is filled with a saturated solution of salt water, and is inverted over the glass or earthenware crock, which a gasket makes air-tight. The glass tube shown, extends to within approximately 3 inches of the bottom of the crock.

The tube measures 3 inches in diameter and is sealed into the top so as to be gas-tight. On an iron rod is clamped the positive carbon, which is connected in series with a 32-cp. incandescent lamp. In the U-bend discharge pipe is a valve which is adjusted for the proper discharge. When the bottle is filled with the saturated salt solution, and the current is turned on, chlorine gas is formed inside the 3-inch glass tube. This gas drives the solution down into the tube until the circuit is interrupted at the bottom of the electrode. If the valve in the outlet pipe is closed or set for a small discharge, this gas will condense, and allow the solution to rise in the tube, re-establishing the circuit and so generating more chlorine. As the chlorine is discharged through the U-tube, new solution is allowed to feed down from the bottle, and the apparatus automatically makes the amount of chlorine within its capacity as required.

A glass tube can be extended through the cover into the large glass tube, thus obtain-



Simple Apparatus for the Electrical Production of Chlorine Gas to Be Used in the Laundry.

ing directly a supply of chlorine gas for bleaching purposes. This apparatus provides a ready means of securing chlorine solution or chlorine gas in small quantities at little expense. It has a wide field as a disinfectant or purifier, and is applicable to many and varied industrial uses.

(Caution. Chlorine Gas is highly poisonous and if taken into the lungs will cause dangerous congestion. It is advisable to place the apparatus in a well-ventilated shaft, carrying the fumes upwardly.—Ed.)

ELECTRICIANS' NON-CORROSIVE SOLDERING PASTE.

One lb. vaseline plus 5 fluid oz. saturated solution of zinc chloride sp. gr. 2.00, plus 1¼ oz. beeswax for a hardener to keep compound from running in warm weather. Melt all and stir well while cooling until emulsion sets. A little on the joint is all that is necessary to solder anything but aluminum.

A Speedy Brass Polish—1.65 oz. oxalic acid pulverized, plus 15.5 oz. Tripoli powder, mix thoroughly. To use, wet a piece of cloth with water and put a little of the polishing powder on, then apply to brass. As the brass tarnish is reduced, wipe off with a dry cloth to a bright luster. To preserve the finish, oil on a cloth rubbed over the polished surface, protects the brass from damp weather making the work lasting.

Contributed by JOHN A. COWING.

A REMARKABLE IMPROVEMENT IN ELECTRIC BELLS.

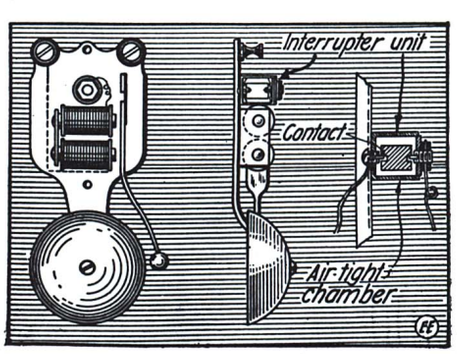
By W. Rademaker.

A new interrupter device, for bells and the like, which is practical and absolutely reliable under all conditions, has been patented lately. This interrupter represents a radical departure from all previous devices. The chief object in view with this invention is to do away with exposed contacts, thereby rendering the device positively water, rust, dust, ice, insect and foolproof. The contacts working in an hermetically sealed, air-tight chamber cannot oxydize or corrode. Therefore, an electric bell has been created which works without the principal source of trouble so frequently experienced with bells now—the breaker-post or contact screw.

The construction and working of the device is very simple. As will be seen in the accompanying illustration a cylindrical piece of metal has a hole drilled into it at each end. A thin sheet-silver bushing is inserted into each of these holes which rest freely upon two small silver points, *making contact with them by gravity.* When the current is closed the loose piece is caused, by the knock of the armature, to be jarred out of contact; thereby interrupting the current and allowing the armature to swing back to its original position by force of the supporting spring. By this time, however, the loose piece has come in contact again with the two points, repeating the action as long as electricity is flowing through the coils.

It may be of further interest to know that the consecutive blows of the armature cause the loose piece to revolve around the supporting points, whereby the contacts are always bound to be kept smooth and free from any possible impurities. The inventor has submitted the device to extremely severe tests, for instance, submerged in water, buried under ground or exposed to acid fumes for weeks, while the bells were continually ringing and are still good for long service to-day. This bell is self adjusting, no matter how many cells it is run on, for the stronger the knock given the cores by the armature, the more will the contacts—which rest upon each other by gravity—become separated, thus adjusting the bell automatically for any voltage.

Again, this bell uses the full magnetic field, because the current is only interrupted *after* the armature has actually hit the



A New Electric Bell Having Its Circuit Breaker Encased in an Air-Tight Tube to Prevent Corrosion of the Contacts. An Extra Rugged Design.

cores. With ordinary bells the armature really never enters the full magnetic field, which is, of course, strongest right near the core, for the current is almost immediately broken when the armature begins to move toward the cores.

HOW TO MAKE IT

This department will award the following monthly prizes: **First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.**
The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of **$3.00** is awarded; for the second best idea a **$2.00** prize, and for the third best a prize of **$1.00.** The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

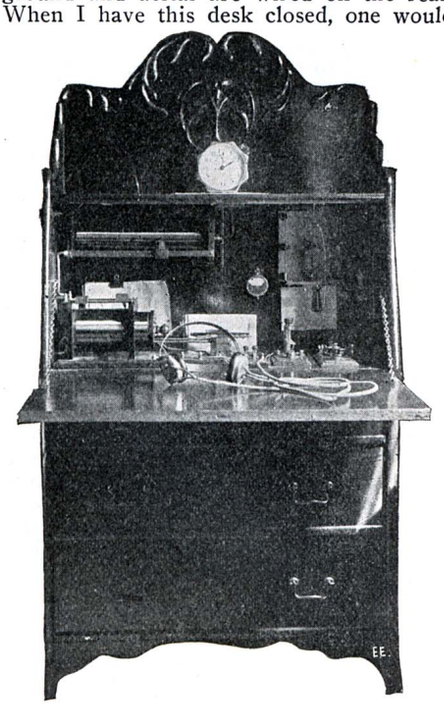
FIRST PRIZE, $3.00

A "DESK" RADIO SET.

Below is a photo of my radio receiving outfit mounted in a desk. It is not necessary to explain the different instruments which I have mounted in the desk as I think any one familiar with wireless will recognize them.

It is not the instruments as much as the manner of mounting them. A desk makes the set fool and dust proof.

I have entered this in your "How-to-Make-It" department, as I believe there are perhaps a few who wish to have a receiving outfit and one that will not require any extra space. The bottom drawers I use for magazines and books. My connections to ground and aerial are wired on the rear. When I have this desk closed, one would



In This Exceedingly Compact Radio Laboratory There Is Combined Neatness as Well as Freedom from Dust and Meddlesome Fingers.

hardly suppose that I have a receiving outfit installed therein. When I open it strangers are always quite surprised to see how neatly the instruments are arranged.

Contributed by JOHN F. CARLSON.

A COLD SOLDER.

Dissolve sulphate of copper in water until the water will dissolve no more. To this solution add bits of scrap zinc until all the copper sulphate goes down in a brown powder; wash two or three times by adding water, let it settle, then pour off the water and dry the powder. When dry, place in an earthenware vessel and add one-fourth as much mercury as powder. Add enough sulphuric acid to just make it into a thick paste, and then wash out the acid with hot water. If the paste is too hard add mercury and if too soft, strain out the excess mercury through chamois or cloth.

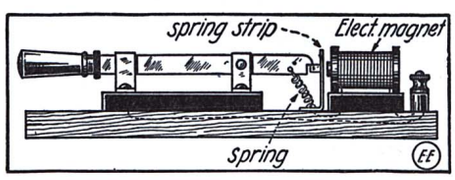
This solder will stand more heat than any other and only a small amount should be used. Before using, wet the pieces to be soldered with a solution of zinc chloride, and apply solder with the finger.

Contributed by H. V. QUINLAN.

SECOND PRIZE, $2.00

HOME-MADE OVERLOAD CIRCUIT BREAKER.

This circuit-breaker can be made at a very little cost. Obtain an electro-magnet to carry the required amount of current and mount it on a base. In front of it



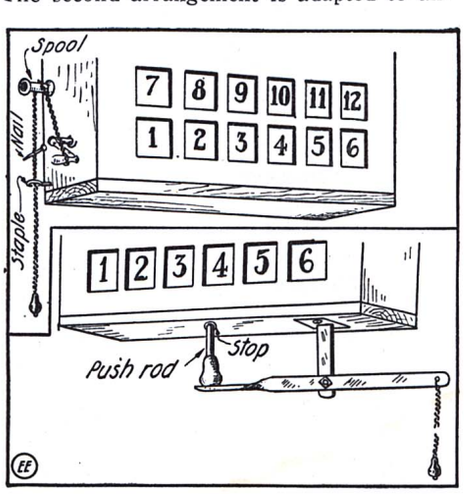
When the Line Current Passing thru the Electro-Magnet Becomes Excessive, the Spring Strip Is Attracted and the Switch Blade Opened.

mount a piece of spring steel as shown in sketch A. If an overload of current be sent through the magnet it will attract the steel spring and release the switch blade, thus opening the circuit. The same thing will happen on a short-circuit. An external resistance may be necessary to adjust the circuit-breaker to open at the right time.

Contributed by H. BOCK.

ANNUNCIATOR HINTS.

A cord, fastened to the reset handle of an annunciator, can be used where the instrument is too high to read. The illustration shows how this is done. A nail between two knots in the doubled string protects the handle against too severe a pull. The second arrangement is adapted to annunciators having a push rod to control the drops.



Clever Schemes for Rigging up a Chain Pull to Reset the "Drops" on Any Annunciator.

Contributed by R. M. MARTIN.

THIRD PRIZE, $1.00

A MOTORCYCLE HEADLIGHT WRINKLE.

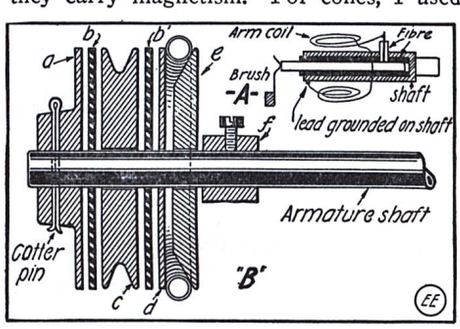
Below is a plan for a motorcycle headlight generator, which I am using successfully with a 21-cp. 12-volt nitrogen Tungsten lamp.

I rewound a four-bar telephone magneto armature with 200 turns of No. 21 D. C. C. for 12 volts. It could also be wound with 100 turns of No. 18 wire for 6 volts.

I replaced the original shaft with a longer one, so as to accommodate a governor pulley which keeps the voltage steady at all speeds, otherwise the lamp would be burned out at high speed.

The shaft may be made of a piece of ⅜-inch drill rod, and can be drilled in from one end with a ¼-inch drill to accommodate an insulated contact pin as in the original shaft shown in the diagram at "A."

The bearings may be made of brass or with a little skill may be made *ball bearing* by using small cups and cones. I used cups taken from a couple of old motorcycle pedals and made them a tight fit in brass plates. Iron or steel will not do as they carry magnetism. For cones, I used



An Automatic Governor Pulley to Prevent Excess Voltage on Motorcycle Dynamo Lamp.

bicycle cones which I annealed so as to drill out a sliding fit on the shaft.

The governor pulley is made up of a brass disc a, with a hub made of a brass nut soldered in the center on one side, and pinned to the end of the shaft with a cotter pin as shown at "B."

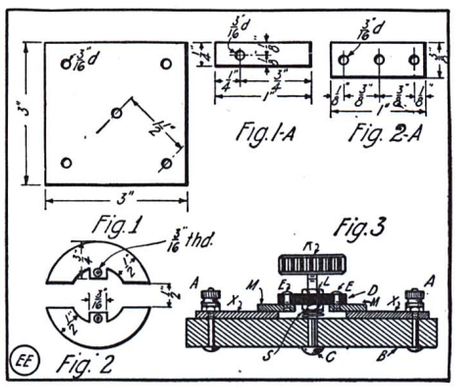
Next comes a 1/16-inch fiber disc b, the pulley c, another 1/16-inch fiber disc b', a flat brass disc d, about 1/16 inch, a ¼-inch fiber or brass disc e, beveled about 45 degrees on one side next to the pulley and a small shafting collar f, made of a brass connector such as used for connecting electrical wires.

Finally you need a tightly coiled spring about 3 inches long x ⅜-inch diameter which goes on the beveled disc next to the pulley. This serves to force discs and pulley together like a clutch, which it really is. On the tightness of the spring depends the generator speed. When the governor reaches the speed for which it is set, the pressure of the spring tends to expand it, thereby causing the clutch to slip and in this way keeping the dynamo speed just right.

Contributed by
ARTHUR W. HUBERTY.

HOW TO MAKE A REVERSING SWITCH.

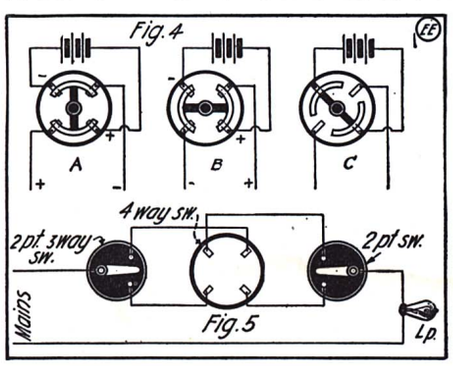
Most experimenters have need at times of a reversing switch, but the cost is usually prohibitive for a good one. The switch outlined herewith is comparatively simple, easy to make, and works on the rotary principle featured in all the newer instruments.



Details of Make-Up of Reversing or 4-Way Switch. Useful in Controlling Lamps or Motors.

The base, Fig. 1, is made of hard rubber or thoroughly seasoned wood, ¼ inch in thickness and about 3 inches square. After the base is shaped, draw diagonal lines from the opposite corners. On each line 1½ inches from their intersection drill a 3/16-inch hole. Another 3/16-inch hole is drilled at the intersection. Now cut four pieces of sheet copper or brass as shown in Fig. 1-A. By means of binding posts inserted in the corner holes in the base and the holes in these strips, the strips which serve for contacts are secured to the base. They should lie diagonally across the base with the long ends toward the center.

The construction of the switch-blades is the next step. On a piece of sheet copper (or brass) lay off two concentric circles and two inches in diameter. The blades may then be cut out and shaped as indicated at Fig. 2. The ends of the blades, also the edges of the contacts, Fig. 1-A, should be beveled so as to work smoothly. The cross-arm to support the two blades should be of hard rubber 1 inch x ⅜ x ¼ inch drilled as shown in Fig. 2-A. Attach as shown in Fig. 3. M M are the blades, D the cross-arm and E E machine screws. Now insert a 3/16-inch machine screw through the base, screw a hexagon nut on it, place the cross-arm over this and screw another hexagon nut over it. The spring S makes far smoother action. Then attach a hard rubber knob for operating the switch and you are ready for business. Connections for this switch in a permanent magnet motor circuit are shown at Fig. 4. Fig. 5 shows how this useful switch can be used with two, 2-point switches, so that a lamp may be turned on or off from any one of three points.

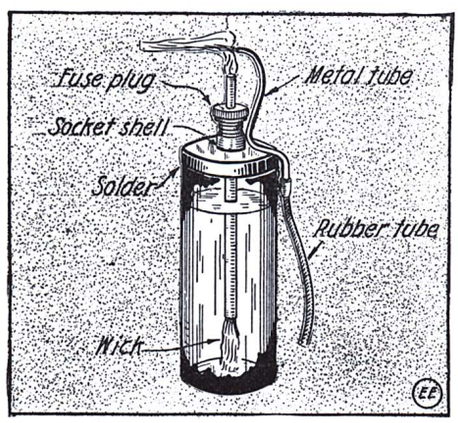


Wiring Hook-Ups for Using 4-Way Rotary Switch.

Contributed by
AN EXPERIMENTER.

ANOTHER HOME-MADE BLOW TORCH.

Secure a tin can with an opening at the top 1 inch in diameter. Take an old socket of regular size and remove the threaded tube. Fit it in the opening, half way in, and solder it in firmly. Next get a blown brass plug fuse, break the mica and pass through a ⅜-inch brass tube and solder them together. Then pass a heavy wick through this tube. Obtain a narrow metal tube, bend to the shape shown in illustration, solder it to the can and part of the socket, attaching to the other end a narrow rubber tubing. Fill the can with alcohol and screw its cover on tight.



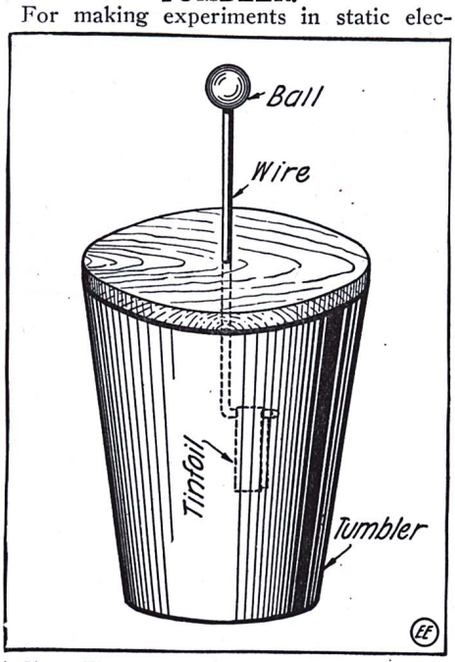
Efficient Style of Electricians' Blow Torch Made from Odd Parts.

Get a ⅜-inch brass plug to cover the brass tube, in order to prevent the alcohol from evaporating.

Contributed by D. JIMENEZ.

ELECTROSCOPE FROM ORDINARY TUMBLER.

For making experiments in static electricity, electroscopes are often used. However, these are too expensive to buy for just a few experiments and thus the experiments are very often never made. Fig. 1, shows the construction of a simple and cheap electroscope which may be made in a few minutes' time. The jar may be a drinking glass or jelly tumbler. The top is a piece of tight-fitting, paraffined wood with a piece of coarse wire driven through the center of it. The lower end of the wire is bent in the form of a hook over which a piece of very thin tinfoil is placed. A lead ball is driven on the other end to prevent leakage.

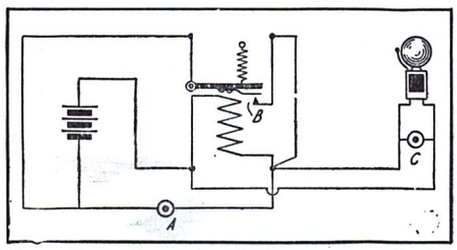


A Cheap Electroscope Constructed from a Glass Tumbler, Wire and Tinfoil.

Contributed by WALTER D. SHOLL.

RELAY CONTROLLED FIRE OR BURGLAR ALARM

When the fire alarm is rung by pressing the push or switching device, as at A, the armature of the relay will be attracted closing the contact at B, causing the alarm to ring. At the same time it maintains a closed circuit through the relay as well as the bell, with the result that the armature holds the contact closed, and the bell rings continually.



Clever Alarm Circuit in which Contact or Push A Closes Relay, Ringing Bell; Push C Opens Circuits.

Another push button C can be suitably placed and so connected that when pushed it will short-circuit the relay and allow the armature to open the circuit. This is quite an advantage over the mechanical reset when the relay must be placed so that it can be reached by the average man.

Contributed by N. M. FERRIS.

FOR THE AMATEUR CHEMIST.

The following is a method for preparing a substance that will detect an acid. In a pot put the outside leaves of cabbage. Cover them with water and boil for ten minutes. The water will have acquired a yellow tint. To test for an acid put some of this liquid in a test tube. Pour a few drops of the suspected substance in and shake the tube.

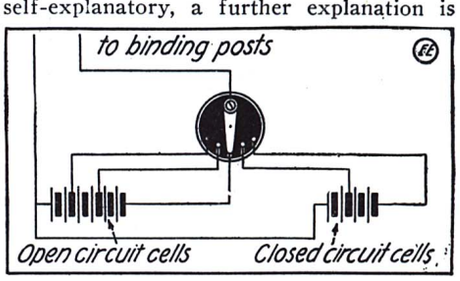
If the yellow color is destroyed the substance is an acid. To make the change more clear, some lime water can be added to the cabbage solution. This will intensify the color of it.

The lime water for the above experiment can be made very easily in the following way: Fill a bottle with water. Put in a few pieces of calcium carbide. After the carbide is slaked, filter the water through a piece of filter paper. This will be lime water.

Contributed by GEORGE E. MINCH.

SWITCH FOR OPEN AND CLOSED CIRCUIT BATTERIES.

The following is a description of a switch that has two uses: first it enables the experimenter to have at his disposal two different sets of cells such as storage or dry cells on one side and Daniel or Gordon cells on the other. As the diagram is self-explanatory, a further explanation is unnecessary, except to state that the greater the number of points on the switch, the greater the amount of current that can be varied.



Switching Scheme for Using Either Closed or Open Circuit Batteries.

Contributed by
EDW. C. CONNELLY.

Experimental Chemistry

By Albert W. Wilsdon

Sixth Lesson

OXYGEN.

[Experimental]

IN the previous issue we went over the occurrence, modes of preparation, and properties of this gas. It is advisable that the reader go over all these details before taking up the experimental part, so that the operator may become familiar with the conditions surrounding the preparation of Oxygen.

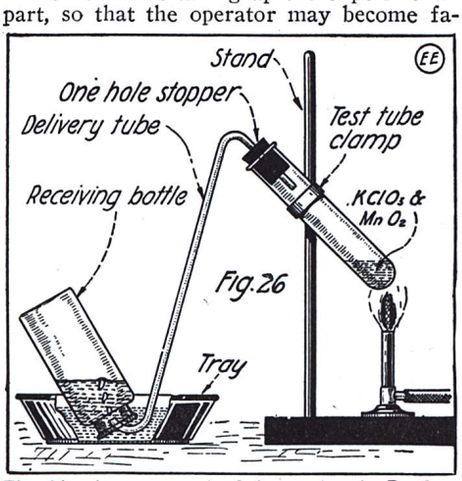


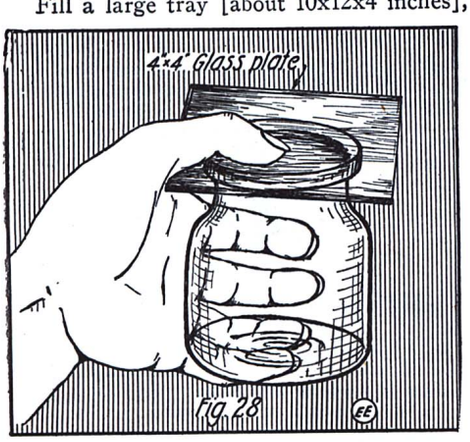
Fig. 26. Arrangement of Apparatus to Produce Oxygen by the Decomposition of Potassium Chlorate.

As stated in the last installment, the gas is usually made in the laboratory by the decomposition of Potassium Chlorate [$KClO_3$], by the displacement of water.

Oxygen may be prepared by the electrolysis of water with the apparatus described in the October issue; it is prepared with the apparatus mentioned by filling the glass chamber with water, to which a little Sulphuric Acid [H_2SO_4] has been added, to better conduct the electricity. The Oxygen is collected at the anode [or positive electrode] and Hydrogen is liberated from the cathode [or negative electrode]. Fig. No. 21 there given, shows how the apparatus is set up and needs no further description. Refer to Methods of Preparation, Method No. 3.

EXPERIMENT No. 16

Fill a large tray [about 10x12x4 inches], or a large pan with water to about 3 inches deep. Bend a delivery tube as shown by Fig. 27. [Note: For method of bending glass tubing, see June, 1916, issue of THE ELECTRICAL EXPERIMENTER, under "Bending Glass Tubing."] Next set up the apparatus as shown in Fig. 26, by pushing the delivery tube through a one-hole rubber stopper which just fits a test tube. [Always remember when inserting glass tubing into a hole in a rubber stopper, to wet both the tube and the hole well, and push the tube in by twisting. Never try to insert a glass tube in a stopper without wetting both tube and stopper.]



The Bottle Which is to Trap the Oxygen, Fig. 26, is Filled with Water and a Plate of Glass Placed Tightly Over it Before Inverting.

Fill 4 eight-ounce, wide-mouth bottles full of water, as shown in Fig. 29, and slide a glass plate [4x4 inches] evenly over the mouth of the bottle, so that no air bubbles remain in the bottle, and when the glass plate is in this position, invert the bottle, grasping it as shown in Fig. 28, and place mouth down in the tray containing the water. When the bottle-full of water is UNDER the water in the tray, remove the glass plate. This will leave the bottle in an upright position, filled with water. Be sure that there are NO air bubbles in the bottle, and if any appear, repeat the operation, till all have disappeared.

Mix on separate papers, about 8 grams of Potassium Chlorate [$KClO_3$] and 5 grams of powdered Manganese Dioxide [also called Manganese Peroxide], [MnO_2]. Mix the two together by stirring thoroughly with a wooden splint or pencil. [It will not be out of place to mention here that Manganese Dioxide [MnO_2] is sometimes adulterated with other substances, which, when heated with Potassium Chlorate, may give rise to explosions. It is, therefore, advisable to test this compound before using, by mixing a little with some Potassium Chlorate [$KClO_3$], and heating in a test tube. If the decomposition takes place quietly, without explosions it may be used for the preparation of Oxygen. [If any slight explosions occur, reject the compound and obtain pure MnO_2. NEVER use this compound, if, after or during the tests, slight explosions occur; to do so, might result in injury.]

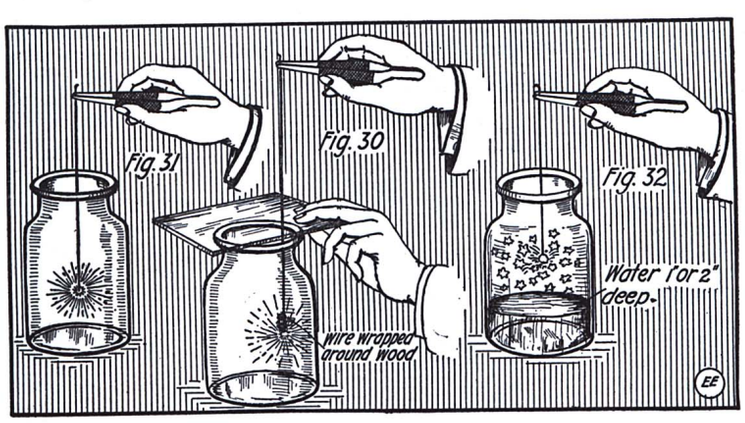
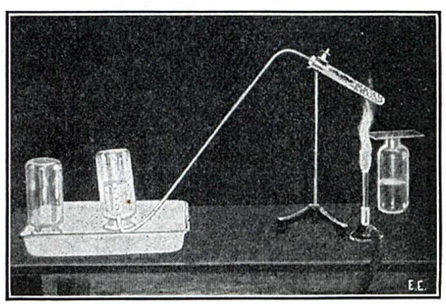


Fig. 30. Showing Glass Cover Slightly Displaced While Experimenting. Fig. 31. Burning Magnesium Ribbon in Oxygen. Fig. 32. Beautiful Effect Produced by Burning Iron Wire in Oxygen.

After both substances are thoroughly mixed in the proportions stated above, pour the mixture into the test tube, spreading it in the manner shown in Fig. 26; connect the apparatus as shown also by Fig. 26. After you have connected the apparatus, place the lower end of the tube under the bottle of water. [Do not lift the bottle from the water, but place the delivery tube under the bottle WHILE UNDER WATER.] This should be done after the first portions of the gas have passed from the tube [which are indicated by bubbles, and which is only heated air, and should be rejected]. After you have allowed this heated air to bubble through the water, place the delivery tube under the bottle, and observe and record any change which takes place, both in the test tube and the receiving bottle. When you have filled one bottle [the indication of which appears by the gas escaping around the sides of the bottle] REMOVE the flame from the test tube, and take the delivery tube FROM THE WATER, being careful not to upset the bottle of collected Oxygen.

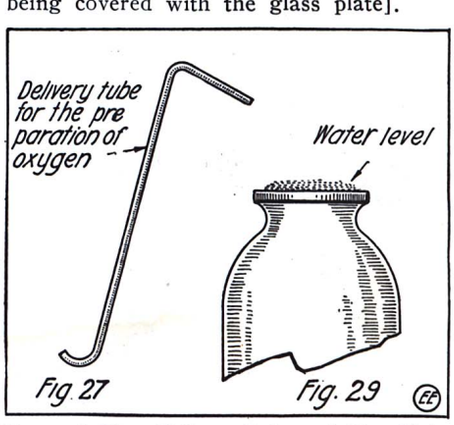


Photograph of Apparatus Shown in Fig. 26 Set Up in the Author's Laboratory.

[Note:—If the delivery tube is allowed to remain under the water after the gas has stopped generating (which is caused by removing the heat) the water will climb into the tube, due to a vacuum action, and if the cold water comes in contact with the hot test tube, it might crack it. This can be avoided by always remembering that when the heat is taken from the test tube ALWAYS REMOVE the delivery tube OUT of the water.]

Place another bottle [filled with water in the same manner as before], and place over the opening of the delivery tube. Prepare four [4] bottles of Oxygen.

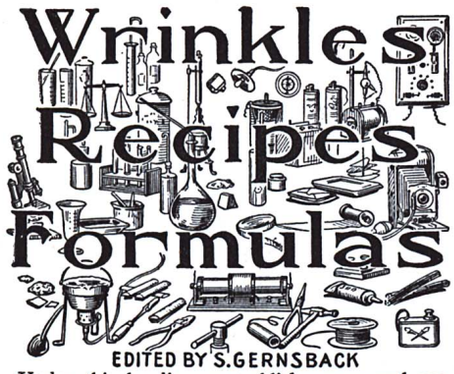
When you are ready to perform the following tests, slip one of the glass plates over the mouth of the bottle, in which the Oxygen has been collected. [Always perform this operation *while the bottle is under water,* otherwise the Oxygen collected will escape and air will be admitted.] Set the bottle right-side up [or with the mouth of the bottle up, still being covered with the glass plate].



Shape of Glass Delivery Tube and How Water Level Rises Above Top of Bottle.

[Note:—It is not necessary to remove each bottle from the water as it is filled; it can be left under water if a weight is

(*Continued on page 524*)



EDITED BY S. GERNSBACK

Under this heading we publish every month useful information in Mechanics, Electricity and Chemistry. We shall be pleased, of course, to have our readers send us any recipes, formulas, wrinkles, new ideas, etc., useful to the experimenter, which will be duly paid for, upon publication, if acceptable.

EXPERIMENTER'S APHORISMS

In the following, we wish to give to the Experimenter some hints as to the use of the different ingredients and how to work them:

(1) Always bear in mind that exact working of a formula requires ACCURACY, CLEANLINESS, PATIENCE, and SKILL.

(2) Know what you are about, before you start to experiment.

(3) "THE HISTORY OF FAILURES IS THE HISTORY OF SUCCESS" goes an old adage, and it applies well to the experimenter.

(4) Many times impure, wrong or deteriorated raw materials, spell FAILURE instead of SUCCESS.

(5) A great many of the chemicals and ingredients required, cannot be obtained from drug stores; buy them at a reputable supply house.

(6) BEFORE CONDEMNING A FORMULA, be sure the fault does not lie with the manner of handling it, or the purity of the ingredients.

(7) Be sure to mix the materials comprising a certain formula in the proper sequence.

(8) When starting to prepare a mixture, especially one containing liquids, ask yourself: "IS THE SPECIFIC GRAVITY CORRECT, AS INDICATED BY A HYDROMETER? IS THE TEMPERATURE RIGHT? IS THE QUANTITY OR WEIGHT RIGHT?

(9) Acids and water, when mixed, should be manipulated in the proper manner, i. e., THE ACID SHOULD BE POURED INTO THE WATER, and not vice versa, as the solution is liable to be forcibly ejected from the containing vessel and into the mixer's face.

(10) For any kind of SYSTEMATIC WORK, a floating THERMOMETER and HYDROMETER, as well as measuring glasses and scales, should always be provided, as GUESSWORK is EXPENSIVE, and SOMETIMES FATAL.

(11) Put labels on ALL bottles, boxes and packages with FULL INSCRIPTION as to their contents, it will avoid troubles and mistakes.

(12) Remember that a beginner cannot expect to make articles AT FIRST, which will compare with regular manufactured products. S.G

FORMULA FOR DISINFECTANT.

1 *oz.*	6 *drams*	*Guaiacol*
1 *oz.*	3 "	*Eucalyptol*
	6 "	*Menthol*
1 oz.		*Carbolic Acid*
	3 "	*Thymol*
	½ "	*Oil Clove*

Enough Alcohol to make 2 lbs.
To be sprayed about with water.

TO PRINT A PICTURE FROM THE PRINT ITSELF.

—The page or picture is soaked in a solution, first of caustic potash and then of tartaric acid. This produces a perfect diffusion of crystals of bitartarate of potassa through the texture of the unprinted part of the paper. As this salt resists oil, the ink roller may now be passed over the surface without transferring any part of its contents except to the printed part.

Magic Paper.—*Take lard oil, or sweet oil, mixed to the consistence of cream, with either of the following paints, the color of which is desired: Prussian blue, lampblack, Venetian red, or chrome green, either of which should be rubbed with a knife on a plate or stone until smooth. Use rather thin but firm paper; put on with a sponge, and wipe off as dry as convenient; then lay them between uncolored paper, or between newspapers, and press by laying books or some other flat substance upon them until the surplus oil is absorbed, when it is ready for use.*

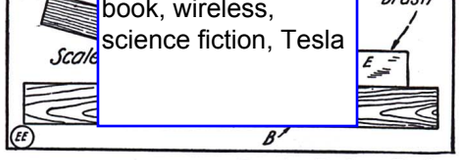
Directions.—For taking off patterns of embroidery place a piece of thin paper over the embroidery to prevent soiling; then lay on the magic paper, and put on the cloth you wish to take the copy on, to embroider; pin fast, and rub over with a spoon handle; and every part of the raised figure will show upon the plain cloth. To take impressions of leaves on paper, place the leaf between two sheets of this paper, and rub over it hard, then take the leaf out and place it between two sheets of white paper; rub again, and you will have a beautiful impression of both sides of the leaf or flower.

DEVICE FOR SHAPING NEW BRUSHES FOR COMMUTATORS

The drawing shows a simple device for shaping new brushes for commutators of motors and dynamos. The strip A is fastened to the board B, while piece C is hinged to B. D is a wing nut and screw, which can be clamped to keep the piece C at its adjusted angle.

The old brush is laid on as shown at E, and C adjusted to the nearest angle. The file is placed on B. The new brush is held against B bearing against the file. This device roughs out the brush to approximately the right shape. The clamp strip A may be graduated to correspond with different angles.

After beveling off the brushes in this way to approximately the correct angle, they are ...ders and shaped t... ...rve accurately by ...aper back and forth under the brush. Hold down on both ends of the sand-paper—not up.



A Time-saving Carbon Brush Facing Device.

Contributed by C. ANDERSON.

EXPERIMENTS OFF THE BEATEN TRACK.

The following experiments are not only interesting, but have the additional charm of novelty, being of a kind that one does not usually come across in the text-books.

For the first there will be required a bobbin about four inches in length with a central hole an inch or more in diameter and having a few hundred turns of double cotton covered wire wound on it. This should be fastened end-up on a sheet of mirror glass and the ends of the wire connected with a source of rapidly alternating current.

Into the hollow core drop a few flakes of black magnetic oxide of iron, prepared as described below. At first no effect will be observed; but let a soft iron bar, or what is better, a bundle of soft iron wire, be inserted for a moment and withdraw; the particles of oxide will at once become endowed with extraordinary activity. The flakes that were formerly at rest will be seen to be dancing vigorously under the influence of the alternating current, the movement being both side to side and up and down. The probable explanation is that the particles of oxide become permanently magnetized during the brief time that the iron core is within the bobbin. The polarity thus induced causes the particles —which, it will be remembered, are in the form of flakes—to present opposite ends to the middle of the bobbin alternately under the influence of the alternating current. The lateral movement is attributed to the mutual attraction and repulsion between neighboring particles.

To make the oxide in the form required for the experiment, cut a piece of tinned iron from a can and leave it in an open fire until the surface is covered with black oxide. If carefully removed and allowed to cool, a little gentle bending between the fingers will detach the oxide in the form of irregular flakes.

The next experiment is even less exacting in the matter of apparatus, only a little finely powdered graphite or bronze powder being required. The current, which may be drawn from the house supply, should be about 200 volts D.C. Two wires should be carried from the lighting circuit, provided with insulating handles for convenience, and having a high-resistance voltmeter in series. Place a small heap of perfectly dry printers' bronze powder on a sheet of paper, and insert the ends of the wires in opposite sides of the heap. The voltmeter will not at first register the passage of a current; but upon gradually bringing the wires closer together the needle is ultimately deflected. After this they may again be separated without stopping the flow of current. Moreover, if the wires are brought fairly close together they may be slowly separated, not only from each other, but from the powder, without interrupting the flow of current. Upon inspection it will be found that the wires are connected either with each other, or with the powder, by an exceedingly fine thread of bronze. With care it is possible to obtain a separation of an inch or so. No doubt the chain is produced by a welding together of the minute particles composing it under the influence of heat, generated by the current. If graphite powder is used, several threads can be drawn simultaneously.

The third experiment to be described is of a very simple character, and only requires a carbon filament lamp and a perfectly dry, warm cloth. Immediately after switching off the current, that is while the lamp is still hot, it should be removed and rubbed briskly with the cloth. The outer surface becomes charged by friction and the inner surface by induction, sometimes sufficiently to attract the filament to the side and hold it there. At the same time a luminous glow is observed in a dark room.

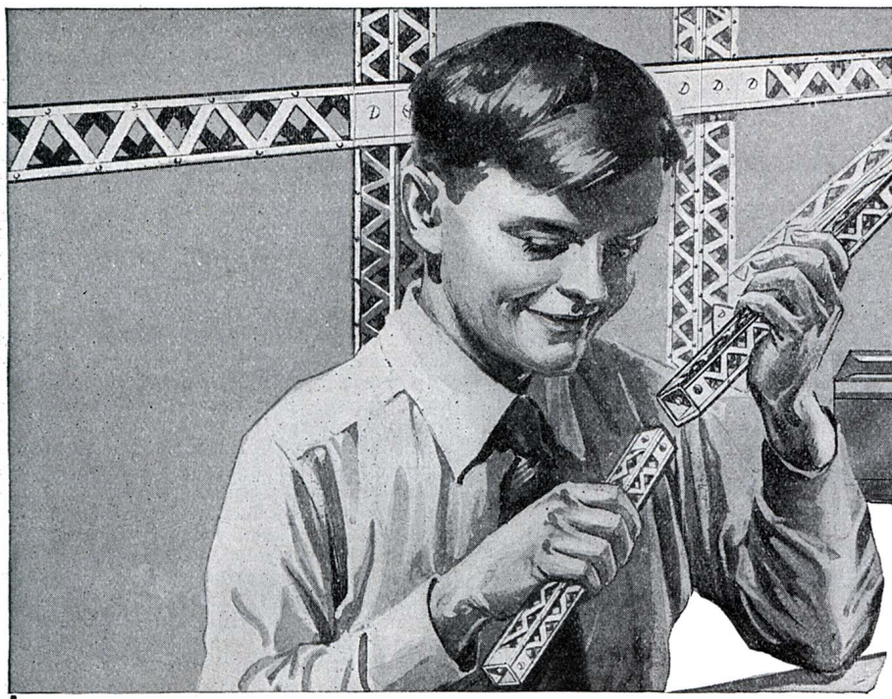
Contributed by H. J. GRAY.

WOOD POLISHES.

A polish for burnished wood surfaces may be made of the following: *Wood Pulp*, 40 parts; *Hydrochloric Acid*, 44 parts; *Chloride of Lime*, 15½ parts; *Turpentine*, ½ part. Mix in the form of a paste and smear over the surface, allowing it to remain a short time and remove it by quick strokes of a soft brush or leather, thoroughly cleaning the surface. Rub gently to a polish with a fresh piece of cloth or chamois.

For very highly polished surfaces the following may be used: Dissolve 5 parts *Potassium Carbonate* in 300 parts *Water;* dissolve in this 500 parts shaved-up *Beeswax* by boiling until the wax is partially saponified, replacing the water evaporated. Remove from the fire and stir until cold; add *Oil of Turpentine*, 800 parts, stir constantly until a smooth emulsion results, then add 800 parts of *Distilled Water*, continuing the stirring. Wash, rinse and dry the surface to be polished. Apply the paste as uniformly and as thinly as possible; rub off with a soft woolen cloth.

Electrical Experimenter, Hugo Gernsback, science, radio, electricity, g-book, wireless, science fiction, Tesla



ERECTOR TOY

FOR

"IT'S GREAT FUN—IT

Hello Boys! Become Er

Greater Fun Th

Valuable Prizes

Enrollment in the "Gilbert Institut

I KNOW what you boy-friends of mine like! That's why I've thought out this new and big idea that will give you more fun than you ever dreamed of before with your Erector, Brik-tor and Erector Electrical Sets.

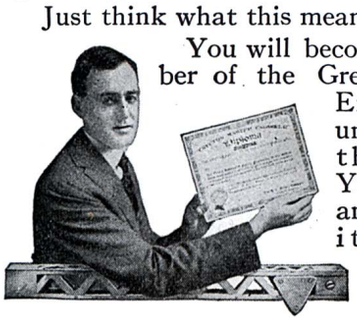
What is the "Gilbert Institute of Erector Engineering?"

You must write for my free, handsome book which contains the whole interesting story. However, the following will give you an idea as to what a big thing it is:—

You know the great yearly prize contests that I have held—giving away Automobiles, Motor-cycles, Canoes and hundreds of other valuable gifts for the best models built by boys.

Now—I am going to continue to give these prizes, and in addition—all boys who send me photographs or drawings of acceptable models of *any* Gilbert Toys, will be given free enrollment in the "Gilbert Institute of Erector Engineering."

Just think what this means to you!



You will become a member of the Greatest Toy-Engineering university of the world. You will have an opportunity to win prizes, honors, degrees and diplomas that you will be proud of all your life. And you will have loads of fun while you are doing it.

Listen! The "Gilbert Institute of Erector Engineering" will confer on boys Three Degrees as follows:

The First Degree—
"Erector Engineer"

The Second Degree—
"Erector Expert Engineer"

The Third Degree—
"Erector Master Engineer"

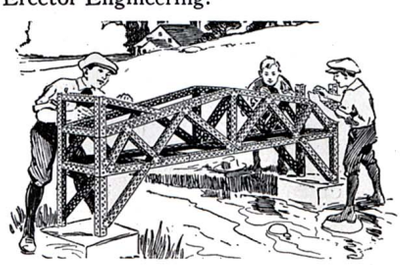
The Valuable Awards Given To Boys Who Win the Third Degree

(1) A handsome diploma ready for framing, conferring upon you the Degree and Title of "Erector Master Engineer."

(2) A beautiful, gold "E. M. E." Fraternity Pin which you can wear on your coat so that everyone will know of your ability.

(3) A salaried position with The A. C. Gilbert Co., during the holiday season, following your winning the "Third Degree." This position is with our Demonstration Corps, and will pay you a salary of $10.00 per week for three weeks with an extra commission of 1% on total sales.

(4) A recommendation, signed by Mr. A. C. Gilbert, for a position with any firm, indicating that you are the type of boy who is sure to make good, and who has won highest standing in the "Gilbert Institute of Erector Engineering."



It will, of course, be necessary for you to secure the First Degree Diploma of "Erector Engineer" before trying for the Second Degree Diploma, and the Second Degree Diploma before trying for the Third and Highest Degree Diploma.

You can secure the First Degree by doing any one of the following three things:

(1) Send me a photograph or drawing of an acceptable Erector model with or without motor attachment.

(2) Send me a photograph or drawing of an acceptable Brik-tor model.

(3) Send me a photograph showing that you know how to put together a motor, the parts of which are included in the Erector Electrical Set.

Get busy right now! Do one of the above things immediately, and I will make you a member of the "Gilbert Institute of Erector Engineering," send you the handsome "Erector Engineer" Diploma, and a Certificate telling just

FOR LIVE WIRE B

EREC

"The Toy Like

Hello, Boys! Do *you* own a set of Erector? If you don't, you have no idea what a lot of fun you are missing.

Erector is the toy for the "live-wire" boy—the boy who has imagination and ability. With a set of Erector, he can build models of the world-famous engineering feats like the Brooklyn Bridge, the Panama Canal, the great skyscrapers of New York City, the Eiffel Tower, and hundreds of other things such as Machinery, Automobiles, Aeroplanes, Battleships, Engines, Printing Presses, Steam Shovels, Farm Implements, etc., etc.

Big Exclusive Erector Advantages

1—The only actual structural steel toy.

2—The only construction toy with interlocking edged girders for building square columns.

3—Most parts for building largest and strongest models.

4—Big, reinforced steel wheels, groved and hubbed for every engineering purpose.

ector Engineers!
an Ever Before! Not Only
for the Best Models, but Free
te of Erector Engineering."

what to do in order to secure the next highest Degree—"Erector Expert Engineer."

Get the complete story of the "Gilbert Institute of Erec or Engineering"!

Fill out the coupon which appears at lower right hand corner of this page; mail it back to me, and I will send you your free copy of my beautiful book which tells all about it, as well as the valuable rewards.

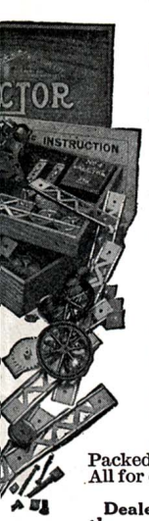
A. C. Gilbert *President.*
The A. C. Gilbert Co., New Haven, Conn.

BOYS—GILBERT'S
CTOR
Structural Steel"

5—Sturdy electric motor that will lift 200 pounds when properly geared, comes free with most sets.

6—Three big illustrated Manuals showing over 500 models. Of course you can build thousands of others as you acquire proficiency.

7—Free membership in the "Gilbert Institute of Erector Engineering" with handsome diplomas and other awards, including the $5000 Prize Contest for Boys.



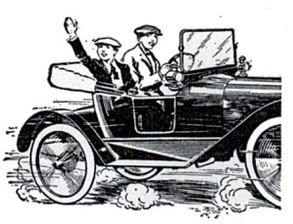
The Famous "FOUR"

Contains every essential engineering part for building thousands of models. Has big girders, large and small wheels, shafting, corner plates, angle irons, pinions, pulleys, gears, nuts and bolts and the great electric motor. Also included is our beautifully illustrated Manual No. 7 showing how to build all kinds of models. Packed in a handsome, hardwood cabinet. All for only $5.00, Price in Canada—$7.50.

Dealers everywhere are glad to show you the new Erector Sets—$1.00 to $25.00.

Valuable Prizes to Boys Who Build the Best Models

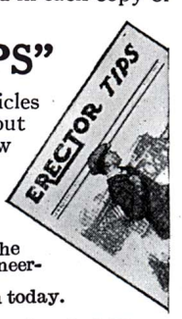
The First Prizes are a handsome Saxon automobile, shown below, and a beautiful Shetland Pony. Other prizes are Motorcycles, Bicycles, Canoes, Camping Outfits and hundreds of other valuable gifts.



Go after these prizes, boys! Gardner Grote—a St. Louis boy—won the first prize of the automobile last year and the Mayor of St. Louis presented it to him. Will you bring this honor to *your* city and yourself this year?

Send photograph or drawing of your model along with properly filled out entry blank. One of these entry blanks is included in each copy of my great magazine for boys—

"ERECTOR TIPS"



"Erector Tips" is full of articles that real boys like. Tells about great athletic achievements, how to do magic tricks, etc.

Contains gripping and thrilling stories, that delight all red-blooded boys.

Also keeps you informed about the "Gilbert Institute of Erector Engineering," the Diplomas and awards.

Send 10c for a year's subscription today.

Here Is the New and Wonderful Toy, Boys! GILBERT'S

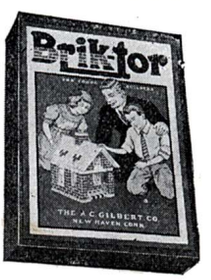
Brik-tor ***"The Toy That Completes Construction Toys"***

Just think what Brik-tor means to every boy who now owns a construction toy set.

It will enable you to complete the framework models that you build with Erector or any other construction toy—and to make finished houses, churches, factories, bridges, tunnels, brick piers, tile walks, and various other models with steel bricks in brilliant color combinations.

Just think of the fun! The price of Brik-tor is $5.00, complete, with a big Instruction Book, beautifully illustrated. Canada—$7.50.

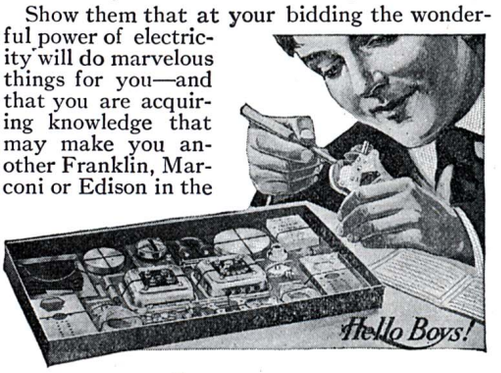
Dealers everywhere sell Brik-tor. Go in and see it or send to me for descriptive booklet.



Great Fun Learning Electricity Secrets

Learn to do electrical experiments and stunts that will make your friends' eyes open with wonder at your electrical knowledge and ability.

Show them that at your bidding the wonderful power of electricity will do marvelous things for you—and that you are acquiring knowledge that may make you another Franklin, Marconi or Edison in the



years to come. Get

Gilbert's Erector Electrical Set and Elementary Course in Electricity

Once you see it, your hands will fairly twitch to get hold of it. You will be able to build your own motor that will operate both backward and forward, and regulate its speed at will, so that your Erector models, mechanical toys, electric trains, etc., can be operated perfectly.

And the great, big, beautifully illustrated book, which comes with every set, will show you how to do more than a hundred intensely interesting electrical experiments—how to build your motor, make magnets, wire door bells, and electric lights, construct switches, etc.

Be sure to get this great Set, boys! There's no limit to its fun. Price $5.00 (Canada $7.50).

Mail back the coupon today for my Free Book

THE A. C. GILBERT CO.,
160 Fox St., New Haven, Conn.

Send me your free book which tells the story of the "Gilbert Institute of Erector Engineering."

Name .....

Street .....

City.....State.....

WITH THE AMATEURS

Our Amateur Radio Station Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of stations unaccompanied by that of the owner. Dark photos preferred to light toned ones. We pay each month $3.00 prize for the best photo. Make your description brief. Address the Editor.

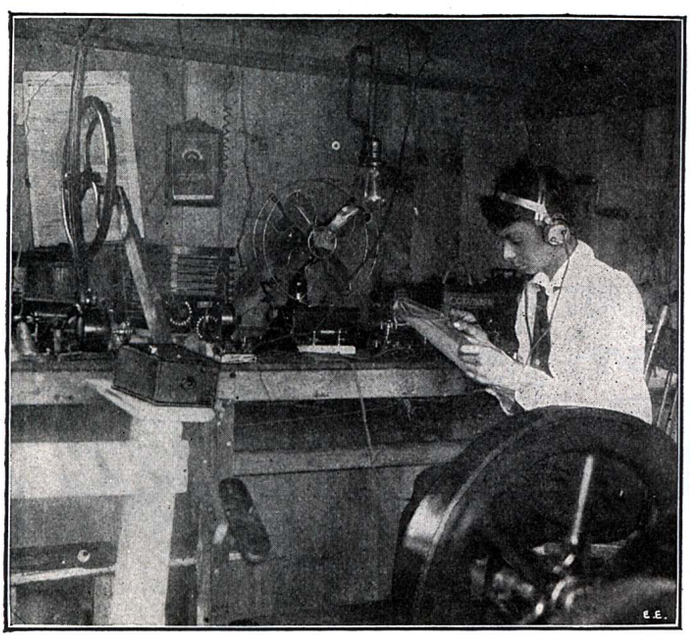
AMATEUR RADIO STATION CONTEST.

Monthly Prize, $3.00.

This month's prize winner.

EXPERIMENTAL LABORATORY OF LIVINGSTON WELCH.

An excellent experimental electrical and radio laboratory is owned by Mr. Welch. He is seen sitting among his various electrical apparatus and we'll bet dollars to doughnuts that there are 90 per cent of our young readers who would like to change places with him. Mr. Welch writes us as follows in reference to his radio activities:



The Excellent Electrical and Radio Laboratory of Livingston Welch.

In my radio transmitter I use a one-inch spark coil, 2 high tension condensers, a spark gap, ½ K.W. helix and a wave meter. I have been heard at a distance of 15 miles. I have two pairs of Brandes' receivers, one 2,000 ohms and the other 3,200 ohms. I use a loose coupler, a silicon detector, loading coil, together with a variable and a fixed condenser.

The aerial is 40 feet high at one end and 30 feet high at the other. It is composed of two strands of copper wire, each 150 feet long. With this set I have obtained very good results, having heard NAA, WSL, WUL, etc.

LIVINGSTON WELCH.

Port Washington, L.I., N.Y.

AMATEUR RADIO SUCCESSFUL IN CAMP.

After one complete year of thorough searching, the National Volunteer Emergency Service, through its operators—Lieutenant Freeman and Private Schwartz—decided that the best outfit for camp requirements was that supplied by the Electro Importing Company. This set is one of their Trans-Atlantic outfits and has served us almost as far as the name implies.

$10,000 CASH PRIZE—IF YOU ARE A "WHALEBONE" EXPERT.

Ten thousand dollars cash will be paid to anyone for the discovery and assignment of all rights in any new practical process for the commercial, profitable and general utilization of *whalebone,* announces Mr. Aaron Sapiro of First National Bank Building, San Francisco, Cal. It has heretofore been used principally in the manufacture of corsets and whips. Such a process, if offered, must be satisfactory, in their exclusive discretion and in all commercial and scientific respects, to the parties authorizing this offer. The offer expires January 1, 1917.

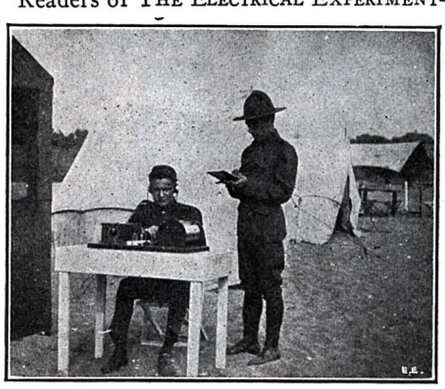
The receiving set consists of a large, double-slide tuner, a loading coil with a very high inductance, a rotary variable condenser of the Gernsback type, and two detectors, a crystaline and a Radioson. The stopping condenser has three different capacities and is manipulated by means of a rubber knob switch. A small switch permits the operators to change from the crystal detector to the Radioson.

The 'phones are also E. I. Co., make and are wound to 2,000 ohms.

For sending, one of their one-inch spark coils is utilized with two three-volt batteries and constant communication with ships in the harbor is carried on.

The set is extremely compact and handsome, and with the aid of a four-wire aerial seventy-five feet long, Key West, Colon, Arlington and other stations are readily heard.

Readers of THE ELECTRICAL EXPERIMENTER are invited to visit the camp at Dyker Beach, Brooklyn, N.Y., and "listen in."



Radio Station at Dyker Beach, N. Y., Operated by Experts of the National Volunteer Emergency Service.

ADOLPH SCHWARTZ,
Call 2 ASK.

Dyker Beach, Brooklyn, N.Y.

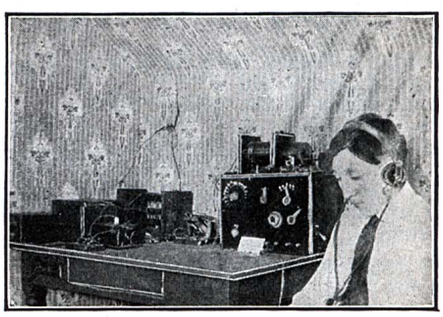
KARL DUERK'S RADIO STATION.

As I am always interested in pictures of radio sets I take this occasion to send a picture and description of my set. It is of my own design and construction and the results have quite exceeded my expectations.

My receiving set is of the cabinet type and contains a loose coupler, two galena and a silicon detector, a large single layer loading coil, a fixed condenser and a variable fixed condenser and Murdock special phones.

My transmitter is composed of a helix, an adjustable high tension condenser, spark gap, 1½" coil and the transmitting key.

I use an aerial 75 feet long and 42 feet high, composed of four copper-clad wires and a lead in of No. 6 copper wire run to the lightning switch.



Karl Duerk Busy at His Radio Instruments.

With this receiving set NAA can be heard with the receivers off—also 8 NS, 8 AEV and about a dozen amateur and several commercial stations.

KARL DUERK.

Defiance, Ohio.

GIRL ASCENDS 426-FOOT RADIO MAST.

Certain repairs had to be made to the top of one of the steel towers of the Marconi wireless station near New Brunswick, N.J., recently, and a workman was assigned to go to the summit, 426 feet above the ground, in a swing operated by ropes and pulleys.

"I'm going up with him!" announced Miss Nellie Albee, daughter of the manager, M. B. Albee.

Her father protested, but Miss Albee said "You took mother up 395 feet Monday afternoon, and I'm going to beat her record."

So the girl took her place in the little bos'n's chair alongside the mechanic and was hoisted to the very top of the tower, where she sat while he did his work.

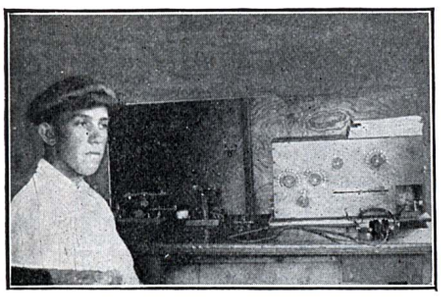
JOHN HAYS HAMMOND TESTING WIRELESS TORPEDO

Sixteen men from the Coast Artillery are assisting John Hays Hammond, Jr., in his experiments with a wireless-controlled torpedo at Gloucester, Mass.

Mr. Hammond will demonstrate his invention before a joint Army and Navy board this fall, as demanded by Congress. A motor boat capable of thirty miles an hour will be controlled by wireless from an aeroplane.

CHARLES HILL'S RADIO EQUIPMENT.

This photo of my wireless station shows the loose coupled tuner of 2,000 meters, 2,000 ohm 'phones, 1,000 meter loading coil, fixed condenser and galena detector. I have just recently enclosed my receiving set in the cabinet. The two switches to the left of cabinet are the primary switches; below there can be seen a 400 meter dead-end switch.



Charles Hill and His Radio Apparatus with Which He Hears Many Long Distance Stations.

The secondary switch is at the right of the cabinet, below is the secondary slider. The loading coil switch is between the secondary and primary switches. The galena detector is mounted on a small door which can be closed when the detector is adjusted. For sending, I am temporarily using a relay which I transformed into a high-tone buzzer until I complete a ¼ K.W. transformer which I now have started to build.

My aerial consists of two stranded copper wires, 4 feet apart, 150 feet long and 50 feet high.

I have had very good results with this station. Some of the principal stations I hear are NAA, NAR and WCC., et cetera.

CHARLES HILL.

Ligonier, Ind.

NAVAL RADIO SERVICE NOW "NAVAL COMMUNICATION SERVICE."

Hereafter, the Naval Radio Service will be known as the *Naval Communication Service*. Charges on all traffic exchanged between other systems (radio, telegraph and cable) and radio stations (ship and shore) operated by the Navy will be accounted for by the Naval Communication Service.

In addition to his other duties, the Director Naval Communications will perform the duties formerly assigned to the Superintendent Naval Radio Service.

Correspondence relating to the Naval Communication Service should be addressed to Director Naval Communications, Radio, Va. Remittances should be made payable to Naval Communication Service. If used, money orders should be drawn on Postmaster, Washington, D.C. Commander D. W. Todd, U.S.N., has been transferred from the command of the U.S.S. *Dixie* to Director Naval Communications. Captain W. H. G. Bullard, U.S.N., formerly superintendent at Radio, Va., has been placed in command of the U.S.S. *Arkansas*.

Hongkong, China, has a wireless station with a radius of from 500 to 700 miles in daytime and more than 1,300 miles at night.

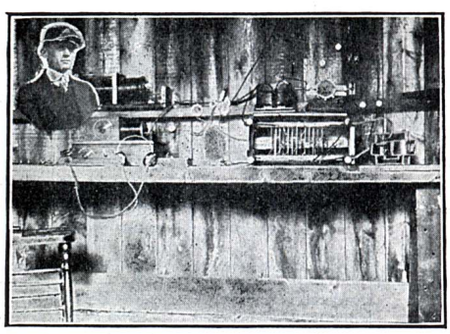
RADIO APPARATUS OF GEORGE R. HAMMOND.

The receiving set of my radio station is as follows: 3,000 meter loose coupler with fixed condenser, galena detector and Superior 'phones. I also use a compact receiving set, consisting of a loose coupler, loading coil, two condensers and galena detector all mounted in and on a cabinet.

The transmitting outfit comprises ¼ K.W. Blitzen transformer, a Sayville rotary gap, hinge type oscillation transformer, glass plate condenser and key.

These instruments, in connection with my aerial, which is at present 40 feet high and 90 feet long, have enabled me to do excellent work. I am able to transmit 30 miles in any weather and on good nights can cover between 50 and 60 miles. At times last winter I have been heard at the Iowa State College Station at Iowa City, which is a distance of about 100 miles.

My receiving range includes 9ZS, 9BC, 9YA, 9YI, 9QF, 9IN, 9KD, and at times have heard Key West, Fla. I am a member of the *United Radio Relay League* and have applied for a government amateur license. My call at present is GRH.



George Hammond and His Ambitious Looking Radio Laboratory.

GEORGE R. HAMMOND.

Oelwein, Iowa.

Amateur News

The South Jersey Radio Association.

On June 12, 1916, a number of the Amateur Operators of south Jersey headed by Mr. C. Walde Bachelor, Wm. G. Phillips, Harry D. Densham, and Geo. E. Haldeman, met and organized the South Jersey Radio Association, with headquarters at Collingswood, New Jersey, the following officers being elected for a term of one year: President, C. Waldo Bachelor; vice-president, George E. Haldeman; Treasurer, Wm. G. Phillips; Secretary, Harry W. Densham.

At the present time the organization is well under way and is affiliating with all the smaller associations throughout the state with the object of forming a strong body to combat any detrimental legislation that may come up and to form an efficient relay service throughout the state.

All clubs wishing to become members of the South Jersey Radio Association should communicate with Harry W. Densham, secretary, Collinswood, N.J.

The Wireless Association of Pennsylvania.

The Wireless Association of Pennsylvania held its regular meeting recently. The past year was one of the most successful for the Association. The success of the organization is due to the excellent work of the Technical Committee and the interest displayed by the members.

The work of the Committee in the past season consisted mostly in the study of the "Vacuum Bulb" as a detector and instructing the members in the requirements for securing Commercial Operators' Licenses.

The majority of the members possess sets which are noted for their high efficiency and long distance work. The Association has the advantage of having as members, men of high standing in the field of Radio activities, and a large number of Commercial operators and wide-awake amateurs.

At the last meeting of the Board of Directors plans were formulated for the work of the coming year. An increased membership is decided upon in order to repay the Technical Committee for its extensive research.

The Association has resumed work with lots of vim. The Secretary would favor any information or correspondence from similar organizations. Robert E. Patchel, Secretary, 532 S. Fifteenth St., Phila., Pa.

Hawkeye Radio Association News.

The Hawkeye Radio Association, Iowa's booming wireless organization, had a big exhibit at the Iowa State Fair, held at Des Moines, August twenty-three to September one, inclusive. A very large antenna was erected, which, with the modern apparatus in the exhibit, enabled them to receive from all the high-powered stations in this hemisphere, as well as those on the continent. Heterodyne receivers and all the latest apparatus were on exhibit and gladly explained. Complete transmitters were installed and working during the Fair under a special license. QST reports, etc., were sent out daily.

During the week of the State Fair the annual convention of the club was held at the Y.M.C.A. building at Des Moines. Lectures, talks, etc., were given by various members and a "Round Table" held. Also the members chose their officers for the coming year and conducted all necessary business. Every radio enthusiast in the State of Iowa was cordially invited to join this club. Any further information will be gladly given. Address, Arthur B. Church, Secretary, Lamoni, Iowa.

Dot and Dash Club of East Orange, N.J.

A Radio Club has been established under the name of the "Dot and Dash Club" in East Orange, N.J. The officers are: President, Charles Summers; vice-president, Cortenay Whitman, and secretary, F. F. Brothers. The purpose of the club is to promote interest in radio telegraphy. Dot and Dash Club, F. F. Brothers, secretary.

RADIO CLUBS ATTENTION!

We are always pleased to hear from young Edisons and Radio Clubs. Send a write-up of your Club with photos of members and apparatus to-day to: Editor "Amateur News" Section, The Electrical Experimenter, 233 Fulton St., New York City.

Now "Bugs" for the Yorkville Radio Development Association.

Now "Bugs" for the Yorkville Radio Development Association. This organization since its establishment has grown lustily and now has a membership of sixty-three. It might as well be said that the position of Secretary has changed hands several times, because the Secretary usually complains of throat trouble after going through the roll call half-way. Most of the members became such only through reading the columns of THE ELECTRICAL EXPERIMENTER.

It might be remembered that the Y.R.D.A. had a write-up in the February issue of THE ELECTRICAL EXPERIMENTER. Well, the Y.R.D.A. obtained fifty members through that write-up, which illustrates the enormous popularity of The E. E. with the scientific men of the country. As the membership has risen to the maximum (sixty-three), it will be impossible to enlist any more new members. The scientific work done by members in four months is given below:

February.—Mr. F. Smith, assistant to Joseph L. Cermak, developed a new chemical compound for use in electroion detectors. It will be put on the market shortly.

March.—Mr. Joseph L. Cermak, E.E., made a combination of chlorine and another gas, which is being successfully used to bleach discolored perlmutter buttons.

Messrs. Cermak, Smith and Goodman presented the Naval Advisory Board with three inventions—namely, a land torpedo, an unsweepable mine and a projectile for use on Zeppelins. They were thanked by the board for their services.

May.—Inventions of small importance were made by the following:

Gas detector, Joseph L. Cermak.

New mineral detector, F. Harvey.

Protection of aluminium-aerial wire from corrosion, F. Smith.

New Audion hook-up, T. Gerad.

Pocket radio set designed, B. F. Badrow.

Phone intensifying diaphragm, Joseph L. Cermak.

Diminutive spark coil of great strength, Joseph L. Cermak.

This completes the work for May. As may be observed, the officers and members have taken a very great interest in the work of developing the radio art.

The President, Mr. Joseph L. Cermak, E.E., 73 East End Avenue, New York City, N.Y., will be pleased to answer all inquiries regarding this Association's work.

OFFICIAL LIST OF LICENSED RADIO AMATEURS NOT TO APPEAR UNTIL THE NEXT ANNUAL GOVERNMENT CALL BOOK.

Amateur Radio Stations Licensed by the Bureau of Navigation During the Month of April, 1916. (Continued.)

EIGHTH DISTRICT—(Cont'd.)

Call signal	Owner of station.	Location of station.	Power kilowatts.
8AIZ	Thornton, Wallace W.	258 Madison Ave., Youngstown Ohio.	.5
8AHS	Walrath, Floyd E.	DeKalb Junction, N. Y.	.5
8AFR	Walser, Arthur L.	Chesaning, Mich.	.5
8JQ	Young Men's Christ. Ass'n.	110 Fourth Ave., Ann Arbor, Mich.	

NINTH DISTRICT

Call signal	Owner of station.	Location of station.	Power kilowatts.
9OE	Andreen, Earl H.	1204 Belknap St., Superior, Wisc.	.5
9AEP	Avery, Norman K.	307 Bigelow Ave., Peoria, Ill.	1
9RD	Bailey, Frank M.	525 Kenilworth Ct., Clinton, Iowa.	1
9CQ	Behmer, Wm.	1335 S. Kolin Ave., Chicago, Ill.	.5
9NP	Buckley, Harold J.	1206 Wrightwood Ave., Chicago, Ill.	.5
9QH	Brockschmidt, Wesley E.	173 Foote Ave., Bellevue, Ky.	.5
9AFT	Blum, Sidney J.	4105 Campbell St., Kansas City, Mo.	1
9AGA	Bornofska, Clar. & Elmer.	1322 Lincoln St., Racine, Wisc.	.5
9AEN	Brewster, Vernon H.	Crystal Lake, Ill.	.5
9AFW	Bechtold, Joe and Fred V.	North Manchester Ind.	.5
9AFS	Busey, Paul G.	911 W. Nevada St., Urbana, Ill.	1
9AEV	Coffman, Scott.	61 N. Gale St., Indianapolis, Ind.	1
9AFU	Clayton, Harold H.	R. F. D. No. 5, Monroeville, Ind.	.5
9NG	Cramer, Wilbur R.	5130 S. 40th St., Omaha, Neb.	.5
9AEZ	Egloff, Edward & Martin.	2729 W. Barry Ave., Chicago, Ill.	1
9AES	Garrett, Hallie C.	810 E. 40th St., Kansas City, Mo.	1
9BZ	Goddard, C.	Shawnee, Kans.	.5
9AEO	Hall, Alfred H.	4015 Alcott St., Denver, Colo.	1
9AEU	Haitz, Fred, Jr.	3901 Fourth Ave., Sioux City, Iowa.	.5
9PB	Hancock, Leverne.	1209 13th St., Superior, Wisc.	.5

NINTH DISTRICT—(Cont'd.)

Call signal	Owner of station.	Location of station.	Power kilowatts.
9AFO	Harris, Harvey P.	902 Burns St., Alton, Ill.	.5
9AFE	Howard, John C.	311 S. State St., Champaign, Ill.	1
9IA	Huckett, Edwin W.	402 N. Oakley St., Kansas City, Mo.	.5
9AET	Huff, Fred W.	4328 Tracy Ave., Kansas City, Mo	1
9AFA	Jaroszewicz, Casimir.	1330 W. 50th St., Chicago, Ill.	.5
9AFD	Krus, Carl.	4652 N. Hermitage Ave., Chicago, Ill.	.5
9QA	Larson, Lee H.	2020 Telegraph Rd., Davenport, Ia.	.5
9AER	Marshall, Geo.	2045 S. Lawrence Ave., Wichita Kans.	
9AEY	Matzinger, Philip F.	1956 W. 94th St., Chicago, Ill.	.5
9PJ	Maxfield, David C.	Le Roy, Minn.	1
9TV	Ostermeier, Cecil H.	529 W. Jefferson St., Springfield, Ill.	.5
9AFG	Nevling, Lorin I.	4240 Maffitt Ave., St. Louis, Mo.	.5
9AFR	Phillips, Claude B.	Lucca N. D.	.5
9AEQ	Richards, John.	2508 Ames Ave., Omaha, Neb.	.5
9AFI	Sprackling, Geo. A.	602 Milwaukee, Ave., Janesville, Wis.	.5
9AFM	Swain, Raymond E.	2828 Highland Pl., Indianapolis, Ind.	.5
9AFN	Swanson, Martin.	1900 Western Ave., Minneapolis, Minn.	.5
9OF	Vollmar, Harold V.	909 Wall St., Milwaukee, Wisc.	.5
9AEX	Wareing, Thomas.	2615 Seminary Ave., Chicago, Ill.	.5
9AFK	Whitcomb, Donald L.	406 N. Lawndale St., Kansas City, Mo.	.5
9PU	Wilhelmy, Lino M.	418 S. Main St., Decatur, Ill.	.5

Amateur Radio Stations Licensed by the Bureau of Navigation During the Month of May, 1916.

FIRST DISTRICT

Call signal	Owner of station.	Location of station.	Power kilowatts.
1KR	Anderson, Andrew R.	29 Lewis St., Lynn, Mass.	.5
1DK	Anderson, Herbert.	833 Norman St., Bridgeport, Conn.	.5
1ES	Armstrong, Leroy W.	135 Point St., Providence, R. I.	.5
1JN	Billotte, Louis C.	10 Centennial Ave., Revere, Mass.	.5
1ESV	Ashland, Homer B.	76 N. Union St., Burlington, Vt.	.5
1MZ	Clark, Lyman J.	Cuttyhunk Light Station, Goswold, Mass.	.5
1SX	Boy Scouts of America Troop 2.	Cambridge, Mass. (License in name of E. L. Gookin, Scoutmaster)	.5
1UF	Caldwell, Raymond P.	18 Morton St., Providence, R. I.	1
1MD	Caswell, Carlton T.	106 Franklin St., Framingham, Mass.	.5
1DH	Cook, Lewis W.	49 Pleasant St., Ansonia, Conn.	.5
1DO	Cook, Witter T.	460 W. Main St., Norwich, Conn.	.5
1SB	Corcoran, Thomas A.	Cambridge, Mass.	.5
1ESW	Dodge, William E.	Beverly, Mass.	.5
1EST	Eaton, Richard E.	59 Lovett St., Beverly, Mass.	.5
1NI	Folin, George G.	133 Buckminster St., Brookline, Mass.	.5
1ON	Cosgrove, Roland D.	14 Wright St., Cambridge, Mass.	.5
1NO	Davis, Orin F.	124 Pearl St., Somerville, Mass.	
1PD	Folsom, Owen F.	89 Hewlett St., Boston, Mass.	.5
1KT	Fruch, Frederick G.	962 South St., Roslindale, Mass.	.5
1SR	Gray, Hollis L.	29 Vine St., Medford, Mass.	.5
1IT	Hahn, P. Francis.	St. Anselms College, Manchester, N. H.	1
1FH	Ham, Miles F.	21 Crosby St., Augusta, Me.	1
1JR	Harding, David W.	Vineyard Haven, Mass.	.5
1ESQ	Hasbrouck, Louis.	130 N. Plesant St., Amherst, Mass.	.5
1OC	Henry, Hugh M.	Rochester, Vt.	.5
1MN	Hodgdon, Milo L.	24 Wachusett St., Worcester, Mass.	
1FW	Holton, Albert M.	11 Florida St., Springfield, Mass.	.5
1AU	Huntington, Charles E.	3 Orange St., Newburyport, Mass	
1DA	Johnson, Arthur A.	Cromwell, Conn.	.5
1MI	Kelly, Richard P.	8 O St., South Boston, Mass.	.5
1DF	Kelsey, Philip C.	Ivoryton, Conn.	1
1NZ	Knight, George W.	29 Central St., Manchester, Mass.	.5
1LZ	Knight, Montgomery	475 Appleton St., Holyoke, Mass.	1
1FL	Larrabee, Charles W.	176 Prospect St., Portland, Me.	.5
1JA	Leathers, John W.	78 Bay State Ave., Somerville, Mass.	.5
1PQ	Leavitt, Vernal A.	26 Lafayette St., Portland, Me.	.5
1MR	Leonard, Frederick D.	353 S. Main St., Mansfield, Mass.	.5
1ESR	Leonard, Theodore.	1188 State St., Bridgeport, Conn.	.5
1UT	Marcroft, Jesse.	Warwick, R. I.	.5
1EY	Marcroft, William.	235 Northup St., Cranston, R. I.	.5
1MC	Murray, Albert F.	21 Norway St., Boston, Mass.	.5
1ND	Mix, Donald G.	1 Kensington Heights, Worcester, Mass.	1
1KN	Plaisted, Frank H.	142 Davis Ave., Brookline, Mass.	.5
1ST	Reynolds, J. Louis.	20 Gordon St., Framingham, Mass.	.5
1GE	Reynolds, William B.	37 State St., Framingham Center, Mass.	.5
1DI	Rhodes, Clarence A.	50 Sedgewick St., Bridgeport, Conn.	.5
1AEN	Rosen, Victor E.	33 Woodlawn St., Lynn, Mass.	.5
1UW	Rowe, Austin E.	110 Loring Rd., Winthrop, Mass.	1
1IM	Senay, Charles T.	Saugus High School, Saugus, Mass.	1
1IV	Sherman, Israel.	55 Revere St., Boston, Mass.	.5
1VN	Southworth, Palmer H.	34 Montowese St., Hartford, Conn.	1
1FY	Stevens, Charles R.	30 Worcester St., Framingham Center, Mass.	.5
1OD	Taylor, Walter A.	3 Thurston St., Somerville, Mass.	.5
1KZ	Waldie, Thomas G.	21 Woodbury St., Beverly, Mass.	.5
1JW	Walker, J. Frank.	Kittery, Me.	.5

SECOND DISTRICT

Call signal	Owner of station.	Location of station.	Power kilowatts.
2AQO	Alexander, Bronson H.	600 W. 183d St., New York, N. Y.	.5
2ARF	Allen, Edwin W., and James J., Jr.	Chatham, N. J.	.5
2ARV	Appell, Daniel T.	41 St. Nicholas Ter., New York, N. Y.	.5
2APE	Averill, William H.	Sayville, N. J.	1
2ARA	Balison, Howard.	361 Eastern Parkway, Brooklyn, N. Y.	.5
2AQP	Bargebuhr, Herbert M.	649 W. 184th St., New York, N. Y.	.5

SECOND DISTRICT—(Cont'd.)

Call signal	Owner of station.	Location of station.	Power kilowatts.
2AQS	Bohman, Albert.	122 Wilbur Ave., Long Island City, N. Y.	.5
2ARG	Bona, Edward.	82 Van Nostrand Ave., Jersey City, N. J.	.5
2ARN	Bremer, Frank V.	3613 Boulevard, Jersey City, N. J.	.5
2ARP	Campbell, George C.	92 Highland Ave., Yonkers, N. Y.	1
2APY	Charleston, Eugene E.	1628 11th Ave., Brooklyn, N. Y.	.5
2ARR	Cohen, Monte.	310 W. 14th St., New York, N. Y.	.5
2KA	Coote, Charles W.	586 177th St., New York, N. Y. Public School No. 115.	.5
2ARX	Dickinson, Edwin A.	1038 Garden St., Hoboken, N. J.	.5
2ARM	Dimmick, E. Ray.	230½ 4th St., Jersey City, N. J.	1
2PM	Faraon, Adolph J.	Belle Harbor, N. Y.	1
2ARC	Ferguson, George M.	303 Stuyvesant Ave., Brooklyn, N. Y.	.5
2AQW	Frankenstein, Edwin S.	97 Bruce Ave., Yonkers, N. Y.	.5
2AQT	Ferris, Clinton S.	409 Smith St., Peekskill, N. Y.	1
2ARS	Grece, Joseph F.	134 Manhattan Ave., Jersey City, N. J.	.5
2AQR	Grover, Paul B.	Toms River, N. J.	.5
2AQZ	Hall, Norman C.	47 Hill St., Newark, N. J.	.5
2ART	Hammond, George P.	1855 70th St., Brooklyn, N. Y.	.5
2AQQ	Hoffman, Frank.	Keansburg, N. J.	.5
2APV	Hymmen, Robert.	100 Armstrong Ave., Jersey City, N. J.	.5
2ARW	Jockers, Edwin B.	142 Ridge St., Newark, N. J.	.5
2APU	Krantz, Hubert K.	183 Argyle Rd., Brooklyn, N. Y.	.5
2AQK	Lambert, Fred F.	300 Sickles Ave., NewRochelle, N.Y.	1
2ARJ	Leiter, David.	262 Delancey St., New York, N. Y.	.5
2ARK	McCoy, Lester M.	R. F. D. No. 2, Peekskill, N. Y.	.5
2ARU	Machlett, Raymond R.	131 W. 188th St., New York, N. Y.	.5
2ARQ	Miller, Raymond H.	327 Hillside Ave., Newark, N. J.	1
2KF	Nolan, George T.	449 E. 183d St., New York, N. Y.	.5
2AED	Oechler, Alfred C.	82 Smith St., Irvington, N. J.	.5
2ARI	Pawley, Myron G.	513 2nd Ave., Asbury Park, N. J.	.5
2ARL	Perry, Irving D.	68 N. Parkway, East Orange, N. J.	.5
2ARB	Plauth, William.	179 Euclid Ave., Brooklyn, N. Y.	1
2ARH	Randell, Edward J.	Fort Totten, N. Y.	.5
2AQY	Showalter, John W.	333 Birch St., Richmond Hill, N.Y.	.5
2AQU	Smith, E. Carter.	572 W. 187th St., New York, N. Y.	.5
2AQV	Sommer, Isidor.	56 Columbia St., New York, N. Y.	.5
2ARE	Southard, Sealey M.	32 Raynor St., Freeport, N. Y.	.5
2APW	Vanderbilt, Harold W.	205 Park Pl., Brooklyn, N. Y.	.5

THIRD DISTRICT

Call signal	Owner of station.	Location of station.	Power kilowatts.
3VG	Applegate, Franklin & Macpherson.	34 Hillcrest Ave., Trenton, N. J.	.5
3QT	Bayard, Arnold.	Woodbine, N. J.	1
3FT	Bisciotti, Bernard J.	608 Carpenter St., Philadelphia, Pa.	.5
3ATN	Briscoe, James D.	Hyattsville, Md.	.5
3VB	Butt, Harvey R.	1307 Moran Ave., Norfolk, Va.	.5
3AEA	Craigie, Stuart M.	511 W. Grace St., Richmond, Va.	.5
3AEW	Dicks, Grover C.	Hagerstown, Md.	.5
3ADR	Endress, John N.	2430 Jefferson St., Harrisburg, Pa.	1
3AHI	Giles, Larkin.	1307 Clayton St., Wilmington, Del.	.5
3ADF	Harrell, Leonard B.	900 Holladay St., Portsmouth, Va.	.5
3PV	Hiestand, Benjamin.	Marietta, Pa.	.5
3AAB	Lansford, Willis R.	3607 13th St., N. W., Washington, D. C.	.5
3QC	Lever, Haseltine S.	Abington, Pa.	.5
3ADE	Layton, Howard H.	805 Washington St., Wilmington, Del.	.5
3DY	Lynn, Thomas H.	Hyattsville, Md.	.5
3SJ	McIntosh, Howard F.	4218 Thompson St., Philadelphia, Pa.	.5
3TS	Mandeville, Francis T.	116 Church St., Boonton, N. J.	.5
3RK	Mecaslin, Harry B.	3903 Hawthorne Ave., Baltimore, Md.	1
3ATM	Morgan, Joseph, Jr.	408 Tioga St., Johnstown, Pa.	1
3IO	Morgan, Joseph, Jr.	314 W. Seymour St., Germantown, Pa.	.5
3AEK	Lewis, Samuel W.	121-B North Mass. Ave., Atlantic City, N. J.	.5
3MY	Moyer, Edgar F.	561 Broad St., Emaus, Pa.	.5
3ADG	Roehm, Sewall.	501 Upland Ave., Noble, Pa.	.5

Continued on opposite page.

OFFICIAL LIST OF LICENSED RADIO AMATEURS NOT TO APPEAR UNTIL THE NEXT ANNUAL GOVERNMENT CALL BOOK.

Amateur Radio Stations Licensed by the Bureau of Navigation During the Month of May, 1916. (Continued.)

THIRD DISTRICT—(Cont'd.)

Call signal	Owner of station.	Location of station.	Power kilowatts.
3AP	Scheetz, Edwin F.	Wyncote, Pa.	.5
3GY	Swinney, Walter, Jr.	815 N. Mount St., Baltimore, Md.	.5
3TF	Thorborg, Martin E.	230 Seymour St., Philadelphia, Pa.	.5
3OZ	Twine, Roy W.	319 W. 28th St., Norfolk, Va.	1
3ATK	Viessman, Warren	2711 Twoly Ave., Baltimore, Md.	.5
3ADW	Walker, Orville R.	134 S. 17th St., Allentown, Pa.	.5
3AIL	Wallace, M. Edgar	38 Prospect St., Trenton, N. J.	1
3AGA	Weikel, John H.	900 Church St., North Wales, Pa.	.5
3AGD	Westlake, Harry T.	1922 N. Broad St., Philadelphia, Pa.	.5
3BR	Witty, Gustav	1608 W. Allegheny St., Philadelphia, Pa.	1
3AAH	Wohlsen, Richard	430 W. Orange St., Lancaster, Pa.	1
3RS	Yearley, Clifton K.	Garrison and Fernhill Aves., Baltimore, Md.	1
3ATO	Zapp, Frederick A.	469 Rutherford St., Trenton, N. J.	.5

FOURTH DISTRICT

Call signal	Owner of station.	Location of station.	Power kilowatts.
4DX	Benning, Broughton W.	50 Whiteford Ave., Atlanta, Ga.	.5
4CD	Elston, Esmond B.	227 5th St., S., St. Petersburg, Fla.	1
4EB	Barrey, Owen J.	Nazareth, N. C.	.5
4CG	Holtzclaw, Ralph C.	Roseland, Fla.	.5
4EA	Huggins, William C.	7 S. 4th St., Wilmington, N. C.	1
4DY	Raffo, James H.	Bay Shore Boulevard, Tampa, Fla.	1
4CA	Shaham, J. Hubert	315 W. 5th St., Rome, Ga.	1
4EC	Shumate, John R., Jr.	600 Clay St., Thomasville, Ga.	1
4DZ	Stone, Hector A.	Lockhart, Fla.	.5

FIFTH DISTRICT

Call signal	Owner of station.	Location of station.	Power kilowatts.
5EM	Dawty, Albert	5918 Laurel St., New Orleans, La.	.5
5EP	Fort, Fred A.	2222 Portland Ave., Shreveport, La.	.5
5EN	Harrison, W. Mace	1003 Elgin Ave., Muskogee, Okla.	.5
5EO	Mottashed, Marvin H.	3126 Lillian St., Shreveport, La.	.5

SIXTH DISTRICT

Call signal	Owner of station.	Location of station.	Power kilowatts.
6RQ	Abrahamson, Ray	4220 California St., San Francisco, Cal.	.5
6OA	Adams, Eugene R.	Mountain View, Cal.	.5
6OP	Altland, Comer P.	662 Clayton St., San Francisco, Cal.	.5
6MQ	Anderson, Sante H.	Mayfield, Cal.	.5
6ON	Becker, Peter J.	2722 Harvard Blvd., Los Angeles, Cal.	.5
6VH	Blackstone, Clifford M.	1606 W. 50th St., Los Angeles, Cal.	.5
6DA	Bolton, Harold B.	4300 Judah St., San Francisco, Cal.	.5
6FY	Bonar, Perry	837 4th St., Santa Rosa, Cal.	.5
6VM	Clark, Herbert	578 16th St., Oakland, Cal.	.5
6QE	Clewett, Heber H.	1002 S. Reservoir St., Pomona, Cal.	.5
6UJ	Day, Elwin C.	907 Valencia St., San Francisco, Cal.	.5
6UV	Fassett, Lee	4326 Balboa St., San Francisco, Cal.	.5
6PP	Ferrill, Wm.	El Cajon, Cal.	.5
6FQ	Foster, Harold M.	630 Culver St., Orange, Cal.	.5
6VG	Fowler, L. Deane	1027 6th St., Redlands, Cal.	.5
6IU	Hutchinson, Howard W.	614 S. Brand Blvd., Glendale, Cal.	.5
6CQ	Kemper, Horace L.	173½ Loma Drive, Los Angeles, Cal	.5
6VJ	Kinsman, Joseph W.	3467 Arroyo Seco Ave., Los Angeles, Cal.	.5
6DR	Laverty, Finley B.	5332 Abbott Pl., Los Angeles, Cal.	.5
6VF	Leigh, Philip P.	827 2d St., Santa Monica, Cal.	1
6UR	Link, Ralph L.	1520 Annan Way, Los Angeles, Cal.	.5
6JJ	Klahn, Leander	27 Chenery St., San Francisco, Cal.	.5
6MM	Moore, Norval E.	652 E. Culver St., Orange, Cal.	.5
6TI	O'Dell, James J.	327 Post St., San Jose, Cal.	.5
6SO	Parkin, Gladys Kathleen	22 Terra Dillo Ave., San Rafael, Cal.	.5
6QC	Perry, Oliver A.	Meridian and Q Sts., San Diego, Cal.	.5
6TK	Robinson, Sidney E.	2929 Broadway, Oakland, Cal.	.5
6DQ	Sleeper, James L.	211 Orange Ave., Santa Ana, Cal.	.5
6KZ	Smith, Harold	3415 Glen Albyn Drive, Los Angeles, Cal.	.5
6QN	Snider, Wallace	2031 E. 1st St., Long Beach, Cal.	.5
6GO	Summers, James W.	1061 62d St., Oakland, Cal.	.5
6GQ	Thurman, Alvin C.	7 Grant Ave., Watsonville, Cal.	.5
6TC	Wright, Howard E.	315 Alvarada Court, Pomona, Cal.	.5

SEVENTH DISTRICT

Call signal	Owner of station.	Location of station.	Power kilowatts.
7KK	Adams, Le Roi T.	364 Monroe St., Portland, Ore.	.5
7OF	Allard, Ambrose	Evanston, Wyo.	.5
7BU	Barrell, Dana A.	839 W. Pennsylvania Ave., Medford, Ore.	1
7OK	Bode, Hugo P.	6315 Beacon Ave., Seattle, Wash.	.5
7CV	Clark, G. Warren	Lents, Ore.	.5
7CA	Crosby, Edward J.	508 E. Sharp Ave., Spokane, Wash.	.5
7CD	De Lacy, Clinton	1906 South J St., Tacoma, Wash.	.5
7NB	Duncan, Thomas W.	802 Gerald Ave., Missoula, Mont.	.5
7CN	Emigh, Charles	335 Grove St., Walla Walla, Wash.	1
7FS	Horstman, Herschel J.	807 4th St., La Grange, Ore.	...
7PJ	Jones, Paul	Wheatland, Wyo.	.5
7NI	Learned, George H.	Forest Grove, Ore.	.5
7LQ	Linsley, Harry	Evanston, Wyo.	.5
7LL	Lunan, Leslie	806 South M St., Tacoma, Wash.	.5
7LN	Lyman, Rollo	905 N. Ave., La Grande, Ore.	.5
7QN	Moore, E. H.	Queen Anne High School, Seattle, Wash.	5
7PK	Palmer, Robert S.	1321 Columbia St., Hood River, Ore.	.5
7PL	Patterson, Fred	865 Williams Ave., Portland, Ore.	1
7JU	Tuerck, John K.	495 Harrison St., Portland, Ore.	.5
7MO	Smith, George M.	Eatonville, Wash.	.5
7UA	Wallace, George H.	Vancouver, Wash.	.5
7AU	Wilkinson, Albert E.	Y. M. C. A. Bldg., Baker, Ore.	.5

EIGHTH DISTRICT

Call signal	Owner of station.	Location of station.	Power kilowatts.
8ACR	Atkinson, Ward I.	95 Rutgers St., Rochester, N. Y.	.5
8AJU	Bell, Charles H.	5153 Flower Ave., Cleveland, Ohio	.5
8AJG	Braatz, Eugene C.	Lowellville, Ohio.	.5
8SV	Bratton, Harry B.	Brecksville, Ohio.	.5
8AEX	Calkins, Norman	2136 W. 100th St., Cleveland, Ohio.	.5
8ASJ	Conner, Charles E.	726 Clinton St., Kalamazoo, Mich.	.5
8ASO	Carr, Irving E.	1246 Roosevelt Ave., Flint, Mich.	.5
8AEG	Cawley, Eugene H.	301 Chestnut St., Dunmore, Pa.	.5
8ASV	Davidson, Robert L.	50 N. 3d St., Newark, Ohio.	.5
8AEY	Davis, Harold P.	2095 W. 87th St., Cleveland, Ohio.	1
8ASD	Dunmore, Wallace P.	218 Main St., Binghamton, N. Y.	.5
8ASK	Evans, Jack H.	806 Bayridge Ave., Pittsburgh, Pa.	.5
8ASH	Finegan, George W.	494 Columbia Ave., Rochester, N.Y.	1

EIGHTH DISTRICT—(Cont'd.)

Call signal	Owner of station.	Location of station.	Power kilowatts.
8ASG	Flory, Carl L.	119 W. Decatur St., Eaton, Ohio.	.5
8ASN	Fisk, Rufus	98 Park Ave., Binghamton, N. Y.	.5
8ASP	Gamble, Howard B.	2537 E. 128th St., Cleveland, Ohio.	1
8ASQ	Greenwell, Robert	6302 Utica St., Cleveland, Ohio.	1
8ADE	Hantman, Alexander	21 Vine St., Pittsburgh, Pa.	1
8AGS	Hart, I. Bruce	1215 S. Arch Ave., Alliance, O.	.5
8AST	Hills, Harold C.	Palermo, N. Y.	.5
8ASG	Howsare, George D.	119 W. Decatur St., Eaton, O.	.5
8AKA	Kepler, Ralph E.	210 Allen St., Dayton, O.	.5
8ASC	Kidd, J. Wm.	606 Cherry St., Niles, O.	1
8AJN	Knott, Charles E.	107 Stedman, Sayre, Pa.	1
8ASA	Lininger, Clarence R.	614 N. Broad St., Ridgway, Pa.	1
8ASB	Millspaugh, Frederick	37 Gaylord St., Binghamton, N. Y.	.5
8AGK	Morris, Carleton D.	31 Monroe St., Monroeville, O.	.5
8ASS	Olney, Clarke	28 Roxford Rd., E. Cleveland, O.	.5
8ASR	Paul, George	2950 E. 57th St., Cleveland, O.	1
8ASL	Proutey, Laurence	175 De Russey St., Binghamton, N. Y.	.5
8ASI	Roe, Millard J.	909 Egleston Ave., Kalamazoo, Mich.	.5
8ASW	Sager, Merel	44 Apple St., Tiffin, O.	.5
8AEE	Schmid, Paul J.	821 Main St., Columbus, O.	.5
8ARY	Spitler, Stephen	Continental, O.	.5
8ASF	Stolzenbach, Robert W. and Charles H.	724 W. Market St., Lima, O.	1
8AD	Stybr, Gilbert	R. F. D. No. 3, Bellevue, Pa.	.5
8ADR	Sullcharger, John A.	1412 Woodbourne Ave., Pittsburgh, Pa.	.5
8IQ	The Electro-Set Co.	3200 Franklin Ave., Cleveland, O.	1
8ASM	Terry, Donald M.	Scott, O.	.5
8FX	Thomas, Norman A.	512 7th St., Marietta, O.	.5
8ARZ	Wilson, Harold H.	Silver Creek, N. Y.	.5
8ASU	Yotter, Francis P.	Freeport, Pa.	.5

NINTH DISTRICT

Call signal	Owner of station.	Location of station.	Power kilowatts.
9AGD	Banks, Archie E.	R. F. D. No. 2, Delmar, Iowa	.5
9AGW	Barnett, Forrest.	2015 Western Ave., Mattoon, Ill.	.5
9AGP	Barrett, Paul G.	3150 Central Ave., Indianapolis, Ind.	.5
9AGX	Bean, Mason	521 E. High St., Jefferson City, Mo.	.5
9AGS	Becker, Paul M.	4427 Greenwood Ave., Chicago, Ill.	.5
9AIC	Bliss, Sidney H.	120 Jackman St., Janesville, Wis.	.5
9AGU	Briscoe, Bertram O.	848 La Salle St., Chicago, Ill.	.5
9AGN	Brittin, Frank L.	1149 W. Edwards St., Springfield, Ill.	1
9AGY	Brodnax, Lewis M.	3526 Walnut St., Kansas City, Mo.	1
9AHU	Buck, Donald N.	3332 Kenmore Ave., Chicago, Ill.	.5
9AHW	Call, George R.	1529 Pearl St., Sioux City, Iowa.	1
9AIA	Campbell, Albert.	4243 W. Congress St., Chicago, Ill.	.5
9AGF	Canary, Elmer B.	810 E. North St., Indianapolis, Ind.	.5
9AIJ	Cook, George S.	1932 Penn. Ave., S., Minneapolis, Minn.	1
9AGG	Cottrell, Gorham J.	1628 Jersey St., Quincy, Ill.	.5
9AGQ	Davis, Herbert	6141 S. Kolbourne Ave., Chicago, Ill.	1
9AHK	Drummond, Ralph.	Oglesby, Ill.	.5
9AGZ	Engel, Roman	664 48th St., Milwaukee, Wis.	.5
9AIF	Fawcett, Lester S.	206 3d Ave., S. W., Independence, Iowa.	1
9AGH	Fenner, Zell G.	23 E. Washington St., Colfax, Iowa.	1
9AIN	Ferguson, Wm. B.	108 N. 17th St., Richmond, Ind.	1
9AGV	Fiedler, Herbert W.	1142 Diversey Parkway, Chicago, Ill.	.5
9AGE	Gamble, Glen A.	4329 Burdette St., Omaha, Neb.	1
9AHA	Gates, George B.	942 Superior St., Racine, Wis.	1
9AHT	Glavin, Roland E.	748 Lawndale Ave., South Bend, Ind.	1
9AGO	Groth, Wm. A.	1534 W. Locust St., Davenport, Ia.	.5
9AHE	Harlin, Paige J.	3704 S. Bryant Ave., Minneapolis, Minn.	.5
9RF	Harmegnies, Paul E.	730 Wisconsin Ave., Oak Park, Ill.	.5
9DY	Healy, Kent T.	849 Willow St., Winnetka, Ill.	.5
9AGG	Herrling, Raymond C.	856 Prospect St., Elgin, Ill.	.5
9QE	Hopkins, Stanley W.	520 Greenleaf Ave., Glencoe, Ill.	.5
9AIL	Howard, Chas. B.	1712 E. Jackson St., Springfield, Ill.	.5
9AU	Iversen, Reginald J.	422 S. 16th Ave., Maywood, Ill.	1
9AIK	Jordan, Jacob	Jefferson High School, Lafayette, Ind.	1
9AGM	Knodle, Almon S.	1942 Talbott Ave., Indianapolis, Ind.	.5
9RO	Lethen, Edward	4312 Greenview Ave., Chicago, Ill.	.5
9AII	Lipe, Corodon C.	1243 W. Wood St., Decatur, Ill.	.5
9AID	Lockhart, Ashton	Casselton, N. D.	.5
9AIM	Mackley, Harry A.	420 Dechman Ave., Peoria, Ill.	1
9AHD	Mase, Harold E.	3335 Hennepin Ave., Minneapolis, Minn.	.5
9AGK	Messing, Marvin M.	27 Shaffer St., Freeport, Ill.	.5
9AIH	Morton, Charles E.	520 Schwartz St., Edwardsville, Ill.	.5
9AHI	Nelson, G. Adolph	5518 W. 8th St., Duluth, Minn.	.5
9IV	Olsen, Winard G.	1454 Pensacola Ave., Chicago, Ill.	1

(To be Continued)

Attention! Radio Amateurs.

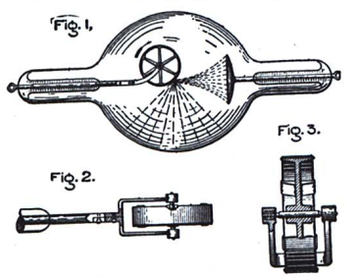
DO you find this advance list of "Licensed Radio Amateurs" published monthly of real benefit? If not, we would just as soon publish additional pages of other matter in the Radio, Constructor and How-to-make-it Sections. Now is your chance to let us know which you prefer. Just mail us a postcard and say —"I ***do not*** want the list of "Licensed Amateurs continued" or "***I do*** want the list of Licensed Amateurs continued." Address the Editor, 233 Fulton St., New York City.

LATEST PATENTS

Improved X-Ray Tube

(No. 1,192,706; issued to Elihu Thompson.)

In this invention over-heating of the focal spot, the part of the surface of the target or anticathode subjected to the bombardment of the cathode rays is prevented by successively renewing the target surface during the operation of the tube, for example, by making the

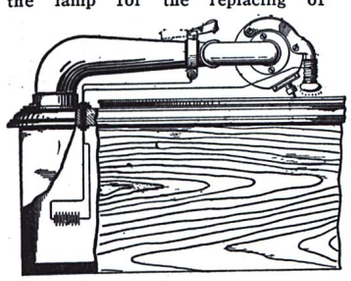


target in the shape of a wheel or disc and rotating the same in any way, as by external means or by the reaction of the rays striking the rim of the target tangentially.

Electric Light for Phonographs

(No. 1,193,825; issued to Clarence H. Roop.)

This patent covers the use of a miniature electric light attached to the phonograph reproducer head and capable of being operated from a flashlight battery. A switch is provided, which, when pressed downward in a forward direction, makes momentary contact lighting the lamp for the replacing of

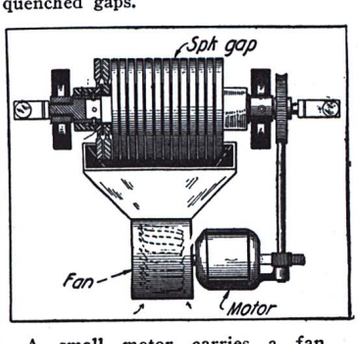


needles when playing in the dark, etc.; when thrown backward it closes the circuit permanently until thrown upward again. It is designed to be manufactured as a separate attachment. A very marketable idea which can be sold at a reasonable price.

Radio Spark Gap

(No. 1,192,909; issued to Fred H. Kroger.)

The inventor of this spark gap for radio transmitting circuits claims to obtain similar results to those attainable with regular quenched gaps.



A small motor carries a fan blade, which projects a stream of air against the multiple metal plates of the gap, and also the motor carries a worm and connecting gears, which rotate the complete gap unit.

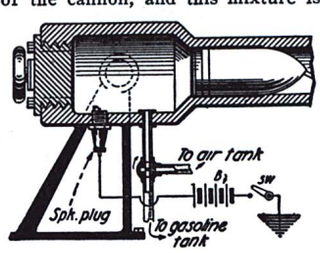
The sparks occur between the exposed plate rims in the open air and occur usually in proximity to the draft tube, which is made of insulating material. Thus, the sparks are caused to take place evenly in so far as wear on the plates is concerned, owing to the rotation of the complete element.

Moreover, this gap serves as a "resonance indicator" for when the gap becomes noisy the circuits are not properly adjusted; when the tuning is good the sparks occur near the center of the plates and the noise is a minimum.

Electric Gasolene Gun

(No. 1,192,839. Issued to Alonzo O. Armour)

A new form of cannon utilizing the energy of an explosive charge of gasolene and air for driving the shell out of the barrel. As becomes clear from the illustration the gasolene and compressed air are admitted in appropriate quantities to the explosion chamber at the breech of the cannon, and this mixture is



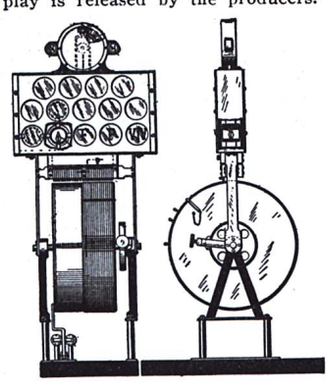
fired by an electric ignition spark plug, thus driving out the projectile with great force.

A suitable mechanism may be used to facilitate the rapid reloading of the gun and other combustible fluids may be used in lieu of gasolene.

Photo-Play Orchestral Director

(No. 1,194,517; issued to Stanley W. Lawton.)

An ingenious idea involving the use of a master musical direction chart, to be made when the film-play is released by the producers.



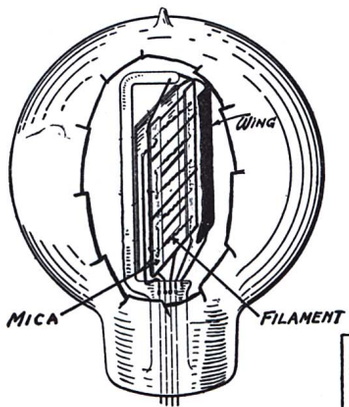
The theater operator places his perforated master chart around the large drum here shown, and in each perforation a plug is inserted. The drum rotates synchronously with the rotation of the motion picture projector mechanism.

The various projecting plugs on the drum operate proper switches, controlling electric lamps behind the glass dial-board before the orchestra director. Each glass disk contains the "key" word relating to the forthcoming section of the picture and the kind of music that is to be played to accompany it. These "keys" represent such terms as allegro, moderato, andante, adagio, tremolo, segue, pianissimo, forte, drum, organ, etc.

Thermionic Amplifier and Rectifier

(No. 1,193,206; issued to Hendrik Johannes van der Bijl.)

An improvement in the filament of a vacuum type amplifier and rectifier, involving an arrangement composed of mica strips, through



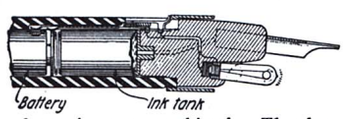
which the heating filament is threaded and thus undue expansion of the filament element is reduced to a minimum.

This permits the filament to be placed in the same, or approximately the same, plane as the grid. The ordinary construction involving the use of supporting springs for the filament has been found to result in a considerable amount of breakage of the heated filament. This of course refers to large, thermionic bulbs of high power rating.

Fountain Pen Flashlight

(No. 1,193,534; issued to Julius Friedman and Joseph L. Friedman.)

A clever design of flashlight and

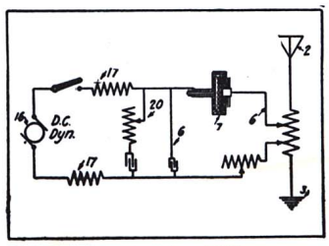


fountain pen combined. The battery supplying current to the miniature lamp, mounted in the pen point, is placed back of a small removable tank containing the ink. The lamp circuit is closed by a spring switch and a threaded sleeve co-acting so as to depress the switch button and keep it there. To open the lamp circuit the sleeve is threaded forward a few turns. A well executed idea but unless the pen barrel is quite large, it would seem difficult to arrange for a reasonable supply of ink.

High Tension D. C. Radio Transmitter

(No. 1,194,154; issued to Melville Eastham.)

An interesting patent covering the use of a 2,500 volt D.C. generator which, with choke coils, forms



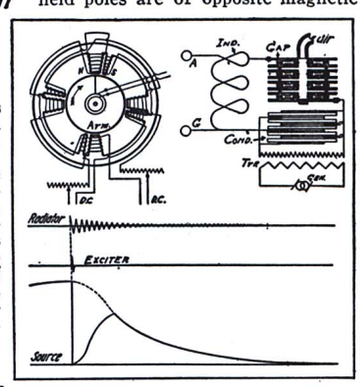
an exciting circuit. This acts on a "reservoir circuit," 20, and an impulse circuit 6. All of these circuits co-act to produce radio frequency oscillations in the radiation (antenna) circuit 2 and 3.

The segmented disc rotary spark gap 7, of well-known pattern, serves to control the frequency of the spark note. The impulse circuit 6, is not oscillatory and oscillations take place only in the antenna circuit 2 and 3. The reservoir circuit 20, helps to keep the energy distributed throughout the system and to realize the highest possible efficiency.

System of Wireless Communication

(No. 1,194,066; issued to John Albert Proctor.)

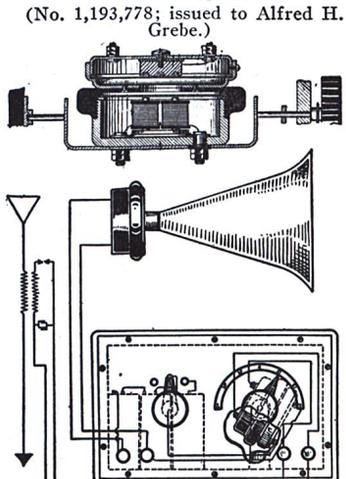
An improved system of radio telegraphy, involving an impact excitation circuit containing a specially designed A.C. generator, as here shown. To obtain the slowly rising, but abruptly falling, A.C. wave form from the alternator, a special field pole arrangement is used. For instance, in the diagram the four larger poles are the regular exciting ones, while the four smaller field poles are of opposite magnetic



polarity. Hence, when an armature inductor revolves in a clock-wise manner, the wave form will be similar to that shown in the graph, resulting in an extremely clean-cut oscillation wave in the radiator (antenna) circuit with practically no reactive wave present, as becomes evident.

Radio Amplifier

(No. 1,193,778; issued to Alfred H. Grebe.)



An amplifier of well-known form intended especially for intensifying the strength of received radio signals. It involves the use of a high resistance, wireless telephone receiver joined acoustically, as indicated, to a sensitive carbon microphone. The microphone controls a low resistance, loud-speaking telephone receiver, fitted with a horn. The receiver and microphone are pivotally mounted in a cabinet, so that it may be rotated slowly to different positions in order to favor the microphone action for different or various signal strengths.

COPIES OF THE ABOVE PATENTS SUPPLIED AT 10c. EACH

Phoney Patents

Under this heading are published electrical or mechanical ideas which our clever inventors, for reasons best known to themselves, have as yet not patented. We furthermore call attention to our celebrated Phoney Patent Offizz for the relief of all suffering daffy inventors in this country as well as for the entire universe.

We are revolutionizing the Patent business and OFER YOU THREE DOLLARS !$3.00 FOR THE BEST PATENT. If you take your Phoney Patent to Washington, they charge you $20.00 for the initial fee and then you haven't a smell of the Patent yet. After they have allowed the Patent, you must pay another $20.00 as a final fee. That's $40.00 ! ! WE PAY YOU $3.00 and grant you a Phoney Patent in the bargain so you save $43.00 ! ! When sending in your Phoney Patent application, be sure that it is as daffy as a lovesick bat. The daffier, the better. Simple sketches and a short description will help our staff of Phoney Patent examiners to issue a Phoney Patent on your invention in a jiffy.

PHONEY PATENT OFFIZZ

O. de DÂMFLY, OF SWATTER, IR.
SCANATARY FLY ERADAKATOR

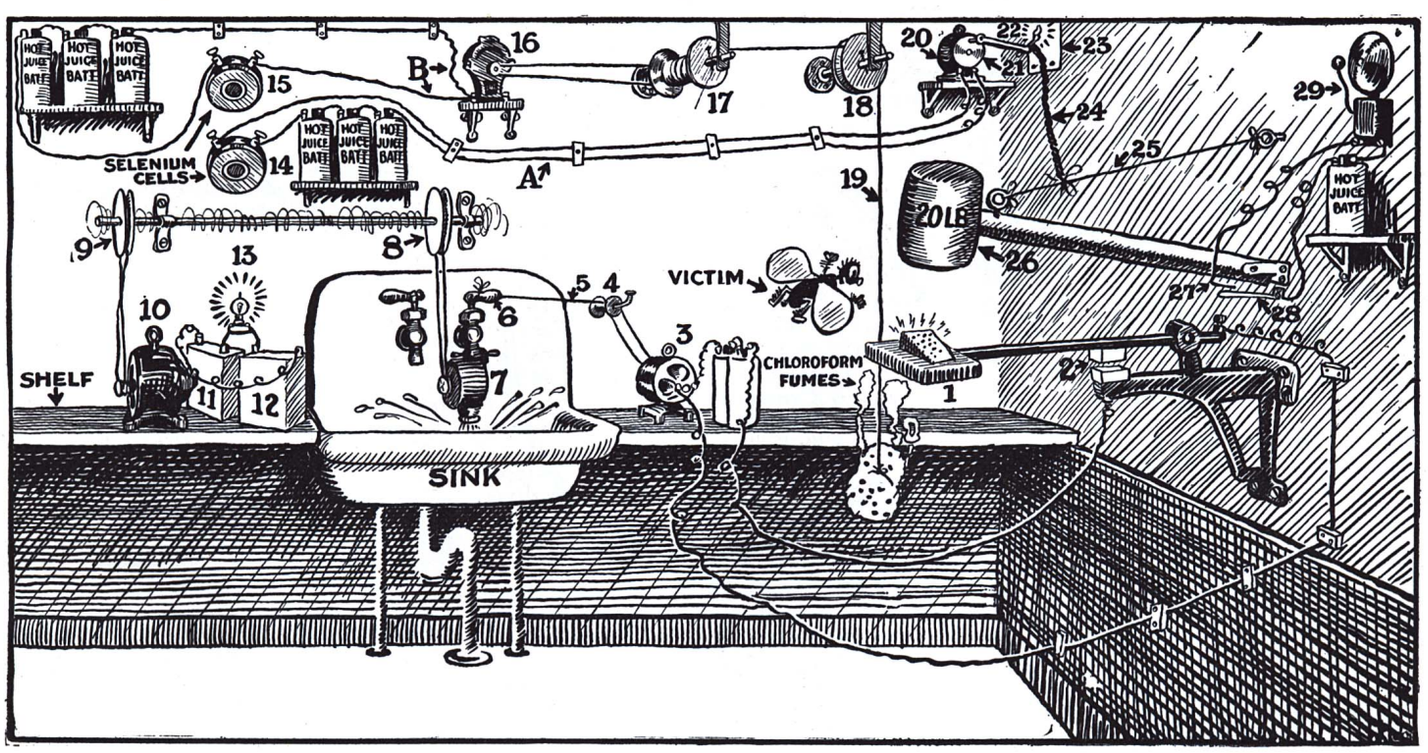
No. .0% / .00% **Swatifications of Paty dufoigrâ** **Patent Afflicted**

To Whom at Night it Consarns:

Know all mutts by these presents, that I, O. de Dâmfly, a citizen of the City of Swatter, in the State of Irritation, have conceived, devised and perfected a mechanism for annihilating annoying flies in a manner that is entirely painless to the victim.

Owing to the compactness and uniqueness of the Fly Eradakator, it is, when installed, out of the way. It should be placed in the vicinity of the kitchen sink. Owing to the wonderful sensitiveness of the selenium cells, the window shades should be drawn so as to darken the room. Now stand with the right foot pointing toward the North Star and the left pedal extremity pointing in the direction of the Patagonian Desert (this is not an allusion to dessert) and the second joint of the briefest digit of the left hand resting on the right side of the nasal protuberance. Having assumed the posture just described, softly but sweetly and clearly make a noise like a lump of granulated sugar, a piece of Limburger cheese or an embarrassed, mortified stewed prune. A fly, on hearing these familiar sounds, will be attracted to the kitchen, after which you may leave and pursue other work until further notice.

The contrivance is then operated as follows: A piece of Limburger cheese (previously steeped in hard cider and then boiled in molasses) has been placed on platinum plate 1. The hungry fly that was lured to the kitchen lamps the cheese and commences to devour it, its bodily weight causing contact 2 to be closed. This starts motor 3, causing spool 4 to revolve and wind up sky-blue pink silken cord 5, thus opening faucet 6. This starts water motor 7, which rotates pulley 8, which turns shaft thus rotating pulley 9 and thence driving dynamo 10, which charges storage batteries 11 and 12. When these batteries are fully charged they light bulb 13, causing selenium cells 14 and 15 to close circuits A and B. With the closing of circuit B motor 16 is started, which turns pulley 17. This pulley unwinds a black linen cord from pulley 18, causing the same to revolve and unwind lavender cotton string 19, to which is tied a wool sponge saturated with chloroform. The fumes from the sponge permeate the atmosphere in the region of the unsuspecting fly and render the poor, innocent thing unconscious. In the meanwhile, as circuit A was closed motor 20 is started, thus rotating disk 21, on the edge of which is mounted cast-tin shank 22. In end of this shank is fastened a blue-tipped match; from the movement given it by the rotation of disk 21 the match is scratched on coarse sandpaper 23 and ignites. This, in turn, ignites slow-burning fuse 24, which burns string 25, causing twenty-pound lead mallet 26 to descend on unconscious fly, thus crushing it beyond recognition. With the falling of the mallet, spring 27 comes in contact with spring 28 and closes circuit, which rings bell 29, thus calling the housewife or maid. She resets mallet and replaces plate 1 with a new one. Plate 1 is now immersed in a pan of whale's milk that has been sweetened with powdered extract of lemon seed in which it should remain for thirteen hours. After this cruel, harsh treatment, it should be wrapped in waxed paper and buried in sandy loam to a depth of fifteen feet. This lessens all danger of infection from dangerous bacteria which might be residing on the crushed corpse.

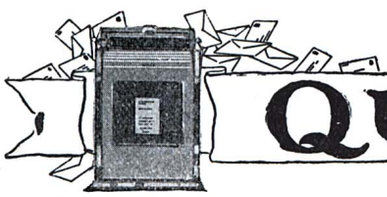


The Highly Ingenious "Scanatary Fly Eradakator" Perpetrated on a Long Suffering Public by one, Monsieur O. de Dâmfly, of Swatter, Ir.

In testimony hereof I afflict my illustrious name this 35th day of April B. C. 1313, just 13,213 years after Queen Aristobulus (who had been ironing King Chedorlaomer's pink burlap pajamas) dropped the hot electric iron on her pet hyena Gibbechai, severely scalding its left eyebrow and causing it, because of this grievous injury, to succumb to the ravages of that terrible disease, water on the brain.

(Signed) O. de Dâmfly,
By his Attorney, Morgan C. Aldrich.

Witnesses:
U. F. Athed.
O. Gohang.
U. Ranother.



QUESTION BOX

This department is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., **must** be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of **25 cents** is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

INTERRUPTER.

(646.) Gustave Geier, West Hoboken, New Jersey, asks:

Q. 1. Could six volts, twenty amperes, battery current be transformed into 110 volts?

A. 1. It is impossible to transform a direct current to a higher voltage. If you employ an induction coil with an interrupter, the primary of which should contain 200 turns while the secondary 3,340 turns; it is then possible for you to obtain the required voltage. The form of current obtained at the secondary would not be a direct current but an unsymmetrical alternating one with an enormous decrease in current value. If this current is passed through a closed core transformer, it would be possible for you to convert it into a more nearly sinusoidal alternating current.

Q. 2. What is the best interrupter, a motor-driven segmental drum with brushes or a vibrating spring contact?

A. 2. The drum driven by a motor is the best type of interrupter between the two you mention, but not for all purposes.

WAVE LENGTHS.

(647.) E. A. Simonds, New Orleans, Louisiana, wishes to know:

Q. 1. What is the wave length in meters of an "L" type aerial, 90 feet long, 50 feet high?

A. 1. Two hundred and fifty meters, if made with four strands.

Q. 2. How is the above figured?

A. 2. The wave length of an aerial is determined by knowing two factors; namely its inductance and capacity. These are determined either by calculation or actual measurement. In the former case, the dimensions of the antenna must be known and substituted in the following equation:

$$W = 59.6 \sqrt{L \times C}$$

Where:—W=wave lengths in meters
L=inductance in henries
C=capacity in microfarads.

The answer to Question 1 was obtained from a curve which shows the wave length of a four wire antenna, having different altitudes and lengths. The curve was plotted from Dr. Austin's formulae and is quite exact.

TRANSFORMER ON PULSATING CURRENT.

(648.) Roland S. Stroup, Oklahoma, wants to know:

Q. 1. If he can use a one-half K.W. transformer-coil and Gernsback electrolytic interrupter to good advantage on a pulsating current, due to irregular speed of generator, with a maximum of 110 volts?

A. 1. You should have no trouble in operating your one-half K.W. transformer-coil with this interrupter on the pulsating current. A little patience in adjusting the interrupter will possibly be required before obtaining the maximum results. The current obtained at the secondary terminals will be alternating. If the transformer is built efficiently, it can be operated directly by the pulsating current without the use of the interrupter. In the latter case a suitable resistance or impedance should be inserted in the primary circuit for controlling the amount of current consumed.

Q. 2. Would the above mentioned apparatus, connected to a 200-foot checkerboard aerial, be suitable to transmit 50-75 miles? The aerial will be 58 feet high at one end and 30 feet at the other.

A. 2. Under favorable weather conditions and with a properly tuned oscillating circuit you should cover the distance you mention.

CONDENSER.

(649.) R. J. Liedel, Providence, Rhode Island, inquires:

Q. 1. If a condenser will be just as efficient when placed in hot wax and allowed to cool so as to form a solid block with condenser inside, compared to a condenser immersed in oil.

A. 1. The condenser immersed in oil is more efficient for the simple reason that when the molten wax is poured into the mould in which the condenser is placed a certain amount of air is drawn in with the wax, thus producing air pockets which reduce the insulating qualities of the whole,

FINAL CALL

On November 1st, 1916, the subscription price of "The Electrical Experimenter" advances to $1.50 in U. S. (Canada and Foreign $2.00.) This is the last chance to subscribe at the old rates ($1.00 in U. S., Canada and Foreign $1.50). No subscription for more than five years at the old rate accepted. THE PUBLISHERS.

and if the condenser is connected to a high-tension source it is liable to break down at the point where there is an air bubble. For this reason it is advisable to place capacity units in oil instead of in wax. The well-known block condensers which are sold on the market are made thoroughly efficient by forcing the insulating compound into a vacuum chamber in which the condenser is inserted.

Q. 2. Which aerial would you advise for a ¼ K.W. transmitting set—an inverted "L" or a checker-board?

A. 2. An inverted "L."

Q. 3. Would a rotary gap be more efficient if it was encased and air pumped into the case to form a higher pressure?

A. 3. The latter would be more efficient for larger power; the former for low power sets, such as one-sixth to one K.W.

LOADING COIL.

(650.) C. E. S., Minnesota, wishes to know:

Q. 1. How to construct a receiving condenser of about .0005 m.f. capacity.

A. 1. The condenser should be made of 2 sheets of tinfoil, each of which should measure 1x3 inches, properly insulated by 5 mil paraffine paper. This is the theoretical capacity. The size should be about doubled as the paper will not lie perfectly flat.

Q. 2. How to construct a loading coil to increase the wave length to 10,000 meters, with a tuning coil, 4,000 meters and a 75 foot aerial 50 feet high.

A. 2. The winding core should be 24 inches long by 6 inches in diameter and fully wound with No. 24 B. & S. copper magnet wire.

BATTERY QUERY.

(651.) J. G. McKlane, Long Island City, asks:

Q. 1. Where can I obtain a battery yielding 10 volts and 10 amperes?

A. 1. You can obtain this battery from any dealer in storage batteries. We would advise you to refer to our advertising columns for manufacturers of batteries and if you write to them they will be pleased to quote you prices.

Q. 2. What is the pressure of the ocean at the following depths: 15 feet, 20 feet, 25 feet?

A. 2. At 15 feet the pressure is about 6.21 pounds, at 20 feet, 8.28 pounds, and at 25 feet, 10.35 pounds per square inch.

Q. 3. Which do you think the most sensitive of the following detectors: de Forest Audion, Audio-Tron, Electron Relay, Radioson, Crystaloi, Tel-Radion?

A. 3. The first three are about alike as regards sensitiveness. The three latter are listed in their correct order of sensitivity.

TIGHT AND LOOSE COUPLING.

(652.) Harold Olsen, Berkeley, California, asks:

Q. 1. What is the essential difference between loose coupling and tight coupling?

A. 1. In the former the energy transformed between the primary and secondary is reduced by the greater separation of the coils, while in the latter it is increased owing to the closeness of the coils. Tight coupling usually involves the employment of an auto-transformer or single coil.

Q. 2. Give composition of an enamel well suited for insulating copper wire and to give a flexible instead of hard brittle covering.

A. 2. We regret to say that we cannot give the composition formula for coating copper wire with enamel, as these are kept confidential by the companies. We would refer you to the September, 1915, issue of this journal, wherein appears an article entitled *Enameled Magnet Wire, Its Properties and Manufacture* by L. Earl Deane, Briefly stated the bare copper wire passes from the spool through the enamel tank, which is usually electrically heated. The wire then runs vertically through an oven, where it is baked at the proper temperature. The oven is provided with electric fans to maintain the temperature even. This process is repeated five times, five coats on a wire, even down to the number 40 B. & S. gauge. Each coat of enamel is baked hard separately before the next coat

(*Continued on page 516*)

BARON MÜNCHHAUSEN'S NEW SCIENTIFIC ADVENTURES.

(*Continued from page 487*)

were when the Martian waterways theory was first expounded by Professor Percival Lowell. Lowell, of course, was right when he stated that the Martian Canals were immense artificial waterways, crisscrossing the face of the thirsting planet. As there is practically no rain on Mars, Lowell reasoned correctly that the canals brought the waters from the melting Arctic snow-caps, to the temperate as well as the tropical zones, thus furnishing the planet with its only possible water supply. During one season the waters would move from North to South, during the next season from South to North. Your mundane scientists had no fault to find with this theory, but what they could not reconcile with their feeble intelligence was the tremendous dimensions of these artificial waterways.

How could any living creatures, no matter how strong physically, build canals 2,000 to 3,500 miles long and from six to twenty miles wide? And not only one such gigantic canal, but hundreds of them! Such engineering feats surpassed all bounds of human understanding. It was simply impossible. Some of your scientists, I well remember, even set up intricate calculations demonstrating that it would take thousands of years to construct such brobdingnagian canals, if dug by an army of shovelers! Another demonstrated to his entire satisfaction, that to dig a water channel 3,000 miles long and twenty miles wide, using 5,000 of the monster Panama Canal pattern steam shovels, would require at least 500 years of uninterrupted effort!

I must admit, that when I first read those figures on earth, I was much impressed and began myself to doubt Lowell's theory. But you see, the great trouble with us humans is that we always compare everything to our existing means, never thinking what superior intelligence might accomplish with means unknown to us. Everything is termed impossible because it is not understood at once.

Necessity is the mother of invention on Mars as well as on earth. If a great and ancient people of a highly advanced civilization see death staring them in the face because of the rapidly dwindling water supply, you may rest assured that such a people will employ its best talent towards warding off such disaster in the face of insurmountable difficulties, even in the face of inexorable nature.

I have since satisfied myself that the Martians are not going to die of thirst for centuries to come. I have also noted with satisfaction how puny your most important engineering feats are, such as the Panama Canal, when compared to a Martian waterway. When I think of your little steam-shovels which I called monsters while on earth, I am convulsed with laughter. They seem so ridiculous, so childlike after what I saw yesterday; a child's tin train, standing in front of one of your "Twentieth Century" fliers, could not be more foolish by comparison.

You see the trouble with your scientists and others was, they never considered that great canals could be dug quite nicely without shovels and steam engines. They never thought of it, because they had never heard of it, hence it was, of course, impossible. You have probably seen an oxy-hydrogen flame at work, cutting through a solid bar of steel as if it had been butter. Well, this is what my first impression was when I saw a new canal under construction yesterday.

The Planet Governor, our august host, after we had managed to make clear our wish, conducted us in one of his gravitational flyers towards the site of the new canal. It was explained to us that this new waterway was to be only a "small' lateral affair, "but" 600 miles long and four miles wide, connecting two of the larger canals together. This particular canal was to open up new fertile territory through an existing part of a desert, by supplying the lands along its banks with water.

Floating at a height of about 3,000 feet we observed miles and miles of the new, already-completed, but as yet waterless, canal stretching to the horizon. The canal was perfectly straight as if laid out with rule and pencil.

In front and below us we saw the strange agency that "dug" the canal with a rapidity that was as disconcerting as it was uncanny. Imagine immense metal latticed towers over one thousand feet high rolling forward on wide colossal wheels. And from the top of these towers you observe bursting forth a broad purple electro-chemical emanation ray plying on the ground below in front of it. This ray, which has the property of disintegrating the ground by breaking up atoms of the desert sands, has immense inherent powers. The ground, rocks, sands, etc., everything "melts" before it, as snow goes up in steam before an oxyhydrogen flame.

Of course, this ray is not hot in itself, it simply reduces all objects to their very atoms. It is a sort of atomic volatization effect—the rocks and sand simply vanish into thin air. The wheeled towers which advance at the rate of about fifteen miles an hour, never stop. Their rays cut through the soil steadily and with an astonishing precision. But the rays do not penetrate deeply, their adjustment being such that the depth of the finished canal measures but ten feet. No waterways on Mars are more than twenty-five feet deep, for they are used solely for the transportation of water, no ships or vessels of any kind ever appearing on a canal.

Of course, you will ask immediately, "What becomes of the 'excavated' material? Though 'volatilized' atomically, it still must needs exist for in Nature nothing is ever lost."

The answer is simple. Take water for example. If you decompose a gallon of it by electrolysis, it vanishes completely. Naturally it has not become lost, it has merely been transformed into its chemical equivalents, i.e., two gases—oxygen and hydrogen.

While you on earth know how to split up the water in its two equivalent gases by means of electricity, you have not as yet succeeded in disintegrating water by breaking up its atoms. Decomposing water, you see, is but a crude mechanical process. It is as if you had cut an ear of corn into two portions by means of a knife; in this operation you have not cut in two all the hundreds of kernels (atoms). This, of course, is but a homely analogy, but it serves quite well to illustrate the idea.

In breaking it up into atoms, matter is transformed into energy, consequently nothing is lost. On Mars the secret of this accomplishment is the purple electro-chemical emanation rays, an invention several hundred years old on this planet.

Upon touching the ground or sands the rays instantly break up the atoms of the minerals, which explode with a terrific hissing noise, like escaping steam. The heat liberated by this process is so enormous that at the point of the ray's deepest penetration, the sand or ground is fused to a lava-like substance impervious to water which the Martians termed Tos. That this is so is indeed fortunate. For, if the Martians were merely employing a simple excavating process, they would have to waterproof the entire canal, to prevent the waters from seeping into the sands. The reason for this is very obvious.

(*Continued on page 539*)

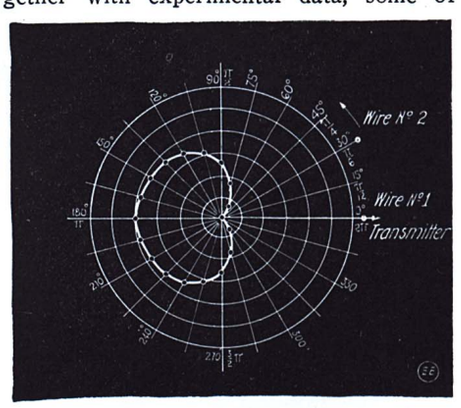
MEETING OF THE INSTITUTE OF RADIO ENGINEERS.

At the recent meeting of the Institute of Radio Engineers held at the Societies' Building on September sixth, two very interesting papers were presented—one on Ground Antennae, given by Leonard F. Fuller, chief electrical engineer of the Federal Telegraph Co., and which gave full details of some of the experiments conducted in 1913 by his company, under his direction.

These experiments were of a somewhat unusual nature, inasmuch as polar graphs were used for plotting the current values registered at the receiving station. A typical curve showing the intensity of received signals is shown in Fig. 1. This shows the relation of two wires, one of which was fixed, while the other rotated about an axis of 360 degrees. At the receiving station a sensitive galvanometer was used for indicating current values received at that station. These currents were plotted in accordance with the rotation of the rotating wire about the 360 degrees.

Several curves were plotted with different lengths of wire and the particular one here shown gives a cardioid or heart-shaped curve. It will be seen that when the wire was pointing 180 degrees *away* from the transmitter, that maximum current values were received at the receiving station.

Several other graphs were illustrated together with experimental data, some of



Graphical Curve of Activity for a Ground Antenna as described by L. F. Fuller of the Federal Telegraph Co.

which has already been published in previous issues of THE ELECTRICAL EXPERIMENTER.

The second paper was presented by Prof. Charles A.Culver of Beloit's College, Cambridge, Mass., which dealt with the subject of Radiation from Horizontal Antennae. He spoke particularly of the special antenna constructed at the Cruft's High Tension Laboratory at Harvard University. The antenna was designed in such a way that it pointed to several different places at each of which receiving instruments were installed.

Data was given for a transmitter operating on 1.9 K.W. and various details showing the amount of current radiated from the antenna and the audibility factor attained at the receiving station. Several tests were conducted and it has been found that an ordinary straight antenna radiating a current of 4.7 amperes to the antenna gave a maximum audibility of 37+. This experiment was conducted at 9.30 a.m.

Both papers were followed by lengthy discussions by Prof. J. Zenneck, Dr. Lee de Forest, Mr. Lockwood, Mr. Armstrong and others.

The problem of *radiation resistance* of an antenna is still in its infancy and there is considerable research work to be carried out in this direction. There is no doubt that the various radio amateurs can perform useful experiments along this line.

Radiocite

"USE RADIOCITE IN YOUR DETECTOR AND FORGET IT"

RADIOCITE is the most wonderful of all radio crystals. It is more sensitive than Galena and far more sensitive than ANY other crystal or mineral. RADIOCITE is a specially selected grade of a rare crystal chemically treated by our own secret process.

The mineral that looks like liquid gold. It has a highly and wonderfully polished surface giving it a burnished appearance. This crystal is now in use by several governments, and is conceded to be the most satisfactory of all. It is used with a medium stiff phosphor bronze spring, or with a stiff silver wire, about No. 30 B. & S. Gauge.

WHAT IT IS

One of the important features of RADIOCITE is that it does not jar out easily. Each crystal is *tested for sensitivity* and guaranteed. RADIOCITE comes packed separately in a box, wrapped in tin-foil. Full directions accompany it. RADIOCITE can be mounted like any other crystal; it may be clamped between springs, but it is best to set it in *Hugonium* soft metal. Money refunded if our claims are not substantiated.

No. 3939. Generous piece of tested RADIOCITE. **Prepaid, $0.50.**

THE ONE UP-TO-DATE MINERAL WHICH EVERY AMATEUR MUST HAVE

Electro Importing Co.,
236 Fulton St.,
New York

Cleveland, Ohio
Sept. 15th, 1916.

Gentlemen:-

Your piece of radiocite received in excellent condition and am glad to inform you that it is without doubt the best mineral ever put on the market. It has any silicon or galena beat forty different ways and back again. I have tried it out on an indoor set consisting of a piece of bare copper wire 20 feet long, a gas pipe ground, a forty cent detector and a pair of Brandes phones. This set was used merely for the purpose of testing Radiocite and the results obtained "knocked me off my feet". I have not yet tried it on my big set but if it works as good as it did on the small set - - why, I'll have "some" set.

Yours truly

R. Black
3161 W. 54th St
Cleveland O.

One of the hundreds of unsolicited testimonials received by us.

IMMEDIATE SHIPMENTS. NO DELAY

Electro Importing Co.,
236 Fulton Street, New York City.

On your absolute guarantee that RADIOCITE is exactly as described by you, I enclose herewith 50 cents in .....for which you are to send me *prepaid* one box containing a generous piece of *tested Radiocite*. You accept my money with the understanding that you will refund it to me at once, should I find the RADIOCITE unsatisfactory. *You guarantee to ship within twenty-four hours or return my remittance.*

Name.....
Address.....
State.....E.E. 11

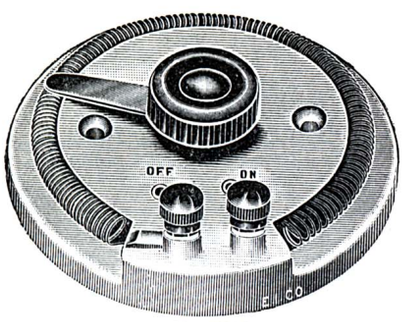
Electro Importing Co.,
236 Fulton St.,N.Y.

Electro-Best

MADE IN AMERICA

The "Electro" Rheostat-Regulator
PORCELAIN BASE

PATENTED FEB. 1, 1910



No. 5000

The only Rheostat on the market with Center Rotary Action.

This little current regulatormakes a valuable addition to any wireless set where it is used to regulate the battery current. **ESPECIALLY WITH VACUUM DETECTORS.**

With battery lamps it is very valuable, where it is used to prevent the lamps from burning out on account of too strong a current, etc.

Advantages over other small rheostats: gradual and accurate regulation of current; great current capacity; little heating, resistance coil air-cooled; no concealed parts; impossible to get out of order. **PORCELAIN BASE. CANNOT BURN OR CHAR.**

The wire used in this regulator is the finest high resistance wire. It will positively not rust, break nor bend, even under a constant load of 3 amperes. This we guarantee in every instance. The groove which holds the spiral is ( ) shaped (PATENTED), which makes it impossible for the coil to fall out or become dislocated. Large hard rubber handle (1 inch in diameter) is provided, allowing rapid and smooth turning of switch blade.

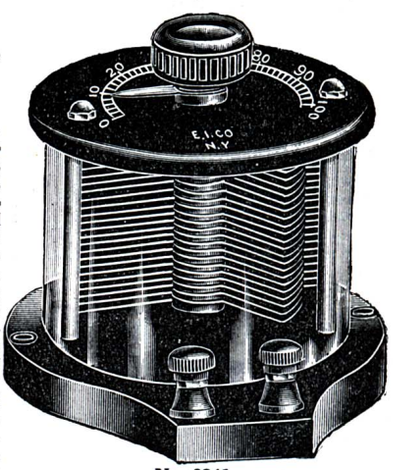
Resistance is 10 ohms. Maximum capacity, 3 amperes continually; size, 4 inches diameter, thickness of base 13/16 inch.

No. 5000. Rheostat-Regulator (patented). Price.... $0.60
Shipping weight, 2 pounds.

The Pride of Every Amateur

The "Electro" Rotary Variable Condensers

Consider these features: **FIRST—THESE CONDENSERS ARE THE ONLY ONES MADE WITH A TRANSPARENT CASE IN WHICH OIL CAN BE USED WITHOUT IT LEAKING.** In this way the condenser capacity can be increased **FIVE TIMES. SECOND—THIS CONDENSER IS THE ONLY ONE NOW ON THE MARKET WITH CONNECTIONS AT THE BOTTOM.** Cover is of highly polished hard ruber composition with a large scale that is easily read.



No. 9241

No. 9240. "Electro" Rotary Variable Condenser, 17 Plates, size 4⅛x3⅞ inches. Shipping weight, 2 pounds. **$2.50**

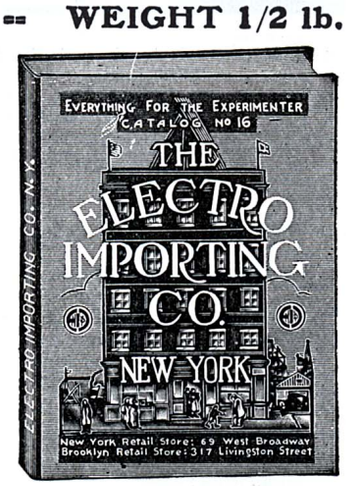
No. 9241. "Electro" Rotary Variable Condenser, 43 Plates, size 4⅛x3⅞ inches, Shipping weight, 3 pounds. **$4.00**

"The Livest Catalog in America"

1/2 inch THICK — WEIGHT 1/2 lb. — 658 ILLUST.

What Catalog No. 16 Contains

It contains the largest assortment of Wireless and electrical experimental apparatus shown in any catalog published. In addition are shown Commercial Wireless Sending and Receiving Outfits, Electric Motors, Dynamos, Flashlights, Medical Batteries, High Frequency Apparatus, Plating Outfits, Toys, Printing Presses, Tools, Sporting Goods and the LARGEST Scientific Book section published. This book will give you as much information as many books that cost you $1.00 or more. It contains 658 illustrations, 2,000 articles, complete Code Chart of Morse, Continental and Navy Codes, sixteen-page "TREATISE ON WIRELESS TELEGRAPHY," list of Call Letters of U. S. Government and Commercial Ship and Shore Wireless Stations, besides a great many useful tables and formulas. This valuable book is 7 x 5¼ inches in size and ½ inch thick, and well bound.



Size 7x5¼"--2000 Articles

It is sent free for 4c. to cover postage only.

Some of the questions answered in Cyclopedia Catalog No. 16:

The Wireless Law of August 13, 1913.
How to Receive Wireless Messages.
How Far You Can Telephone by Wireless.
Wave Lengths of Principal Radio Stations.
How to Erect a Wireless Aerial.
How to Receive Time by Wireless.
How to Photograph Electrical Discharges.
How to Experiment with Spark Coils.
How to Test Storage Batteries.
How to Make Tesla Experiments.
Call Letters of all Commercial and Government Wireless Stations.

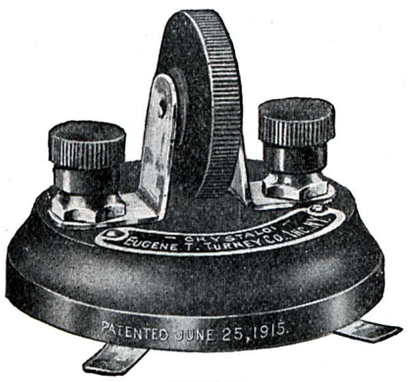
Electro Importing Co.,
236 Fulton Street, New York City.

I enclose herewith 4 cents in stamps or coin for which please send me your latest Cyclopedia Catalog No. 16 containing 275 pages, 658 illustrations and diagrams, including Treatise on Wireless Telegraphy, complete list of all U. S. Wireless Call Letters, and 20 coupons for your 160 page Free Wireless Course in 20 lessons.
E.E 11

Name .....
Address .....
State .....

Electro Importing Co.,
236 Fulton St., N.Y.

THE CRYSTALOI DETECTOR



TYPE O
Dimensions 2¼" x 1⅞" Price $3.50
Postage 10 cents
Over 10,000 in use

If you want a detector that is extremely sensitive and thoroughly reliable, you need a CRYSTALOI.

Wireless Operators on land and sea prefer the Crystaloi for the reason that it is always ready. You have but to turn the little wheel to secure fine adjustment.

Guaranteed not to go dead or lose its sensitivity.

Send five cents for our miniature catalog describing all types of Crystalois and other wireless apparatus.

EUGENE T. TURNEY CO., Inc.
2595 Third Avenue New York City

EXPERIMENTERS!!

WE SPECIALIZE IN

SEAMLESS CARDBOARD TUBING

IN SIZES SUITABLE FOR
TUNING COILS, LOOSE COUPLERS, TESLA COILS, Etc.

SPECIAL GRAY TUBES
18"x6½"x6⅞" $1 ea. 18"x7½"x7⅞" $1 ea.

PRICE LIST
Smooth Wound Wireless Tubes

Outside Diam.	Lgth.	Price	Par. Post
3	x 7½	.12	.18
3½	x 7½	.12	.18
4	x 7½	.15	.22
4½	x 7½	.20	.27
5	x 7½	.25	.31
5½	x 7½	.25	.33
6	x 7½	.30	.37

GENERAL INFORMATION

These prices include PARCEL POST CHARGES: and are shipped at once on receipt of order and remittance.

We CANNOT furnish these tubes in longer lengths than 7½" unless ordered in quantities of 100 of a size.

We CAN furnish SPIRAL WOUND TUBES in any length up to 45 inches at .02 per inch in the following inside diameters, 3½-4-4½-5-6.

BEETLE & MACLEAN MFG. CO.
21 BROMFIELD ST. BOSTON, MASS.

BOSTON WIRELESS

Rotary Condenser, 43 plates, .001 M.F., $3.75
Tuner, $2.50. Spark Gaps, 60c. and $1.00
Detectors, $1.00, $1.75, $4.00
Loose Coupler, $7.50, 1500 Meters

Agent for A. W. Bowman & Co., Adams-Morgan Co. Manhattan Spark Coils. Catalogue for 2c. stamp.

M. MUELLER, 18 Devonshire Street, BOSTON, MASS.

QUESTION BOX.

(*Continued from page 512*)

is applied. The finished wire is run off on to spools.

Q. 3. Is the Trust holding back the supply of copper, or is there not enough copper to supply the demand for it?

A. 3. There is not enough copper to supply the enormous demand, hence the increase in price.

BALSILLIE RADIO SYSTEM.

(653.) J. Hanson, Washington, D.C., asks for:

Q. 1. A diagram of connection of the Balsillie system.

A. 1. The diagram gives connections: The current of frequency 350 cycles is taken from the rotary converter A. B is a choke coil. The transformer C, D, is an open magnetic circuit transformer. The gap E is air-cooled with the object of preventing the formation of an arc. F, G, and H are condensers. J and I are choke coils. It is a *shock* excitation system.

Q. 2. What do you consider the best means of communication, by using either the damped or undamped waves?

A. 2. For short range transmission, the damped transmitter is far more efficient as explained in one of our previous issues. When employing a sustained wave apparatus the current is being continually generated and emitted by the antenna and is interrupted only when signals are sent out.

Q. 3. Does the formula for the frequency of an ordinary oscillating circuit cover the frequency of the Lepel system?

A. 3. No. It has been found by Naysmith

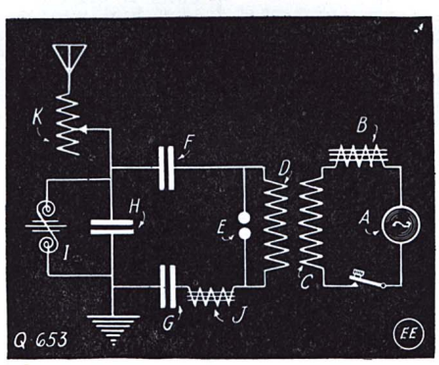


Diagram of Connections in the Balsillie Radio System.

that the Lepel circuit obeyed the following equation:

$$N = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{l^2d^2}{4L^2I^2}}$$

where:—N=frequency
l=length of arc
d=constant depending on the metal of the gap and the gap atmosphere; I is the arc current and L C is the product of inductance and capacity in the oscillating circuit.

AERIAL QUESTION.

(654.) William Walker, Williamsburg, Pennsylvania, asks:

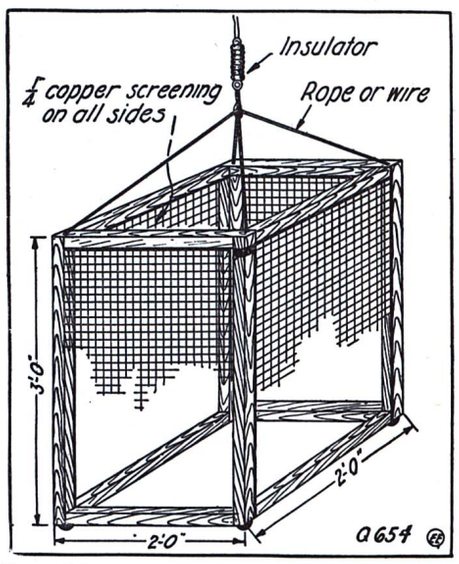
Q. 1. Would an aerial of the type shown in the diagram be efficient, and if not, why?

A. 1. The antenna will prove satisfactory for short range work.

Q. 2. What is the wave length of my aerial, which is composed of three strands of No. 18 B. & S. gauge copper wire, each 150 feet long and having a mean height of 30 feet?

A. 2. 435 meters.

Q. 3. What is the wave length of my tuning coil wound on a tube 13 inches long and 2¾ inches in diameter, wound for 11¼ inches of its length with No. 23 B. & S. gauge enameled magnet wire, and provided with a single slider? Would it increase the



Type of Radio Antenna Suitable for Short-Range Work.

efficiency of my set to add another slider?

A. 3. 560 meters. It would increase your tuning efficiency considerably by adding another slider.

SLATE AS AN INSULATOR.

(655.) Charles W. Squires, Port Jefferson, New York, inquires:

Q. 1. What is the efficiency of the compressed air gap as compared with a straight and other gaps?

A. 1. The compressed air gap is more efficient than the ordinary straight open gap.

Q. 2. Is slate a good insulator? A prominent manufacturer of electrical goods states that it is not, at least not for currents above 1,000 volts. At such a tension slate begins to "leak."

A. 2. Slate as an insulator is very poor. However, it is extensively used on low voltage circuits not exceeding 300 to 500 volts potential.

FREQUENCY CHANGER.

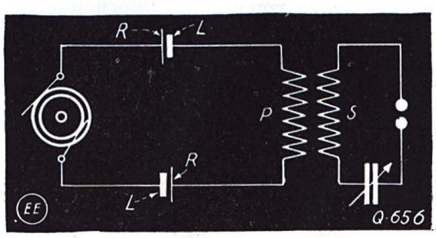
(656.) P. Poulson, Atlanta, Georgia, wishes to know:

Q. 1. What is the inductance of a choke coil having 400 turns, the iron core being 60 cms. long and of 300 sq. cms. cross-sectional area? Kindly tell me how you obtain the result.

A. 1. The equation for the inductance of a choke coil is:

$$L = \frac{1.26\ N^2uA}{10^8\ l}$$

where:—N=number of turns
u=permeability of iron core; in this case we will assume it to be 1,500.



Using two Electrolytic Rectifier Cells to Double the Frequency in a Radio Transmitter.

A=mean cross-section of core in sq. cms.
l=length of core in centimeters.
Substituting the values given the problem,

(*Continued on page 518*)

THE ELECTRO-SET CO.

THE BIG SQUARE SUPPLY HOUSE FOR EXPERIMENTERS

BRIGHT YOUNG MEN AND STAID OLD COLLEGE PROFESSORS ALL JOIN IN PRAISING OUR METHODS

Here are some random testimonials—hundreds more just like them in our files. They should convince you.

From Arthur R. Birkibs, Bronxville, N. Y.
Dear Sirs: You certainly sent the goods very quickly. The Galena and silicon are the most sensitive minerals I ever chanced to use. They are sensitive all over. Your catalogue has the most complete line of wireless and electrical goods I ever saw.

From Forrest Adams, Shawnee, Okla.
Gentlemen: Received your catalogue and it sure has some values in it. The raise in prices are lower than in other catalogue raises.

From Wm. Howard Garkener, Brandon, Man., Can.
Gentlemen: I have received the Tele-Set and the Boy Scout Secret Service Writing Outfit. The writing outfit is something to talk about. It works great and so does the Tele-Set.

From George Bilgam, New York City.
Gentlemen: As to your N. A. A. tested Galena: It cannot be praised highly enough. There is not a "dead" spot on the entire crystal and can assure you that I am recommending it to my friends.

From H. F. Buckingham, Monroeville, Ohio.
Gentlemen: I purchased one of your one-half-inch spark coils, and it will give a three-fourth inch spark with ease, and have sent ten miles with same.

From John Doering, Rock Island, Ill.
Gentlemen: I am writing you this letter to thank you for the kind attention you showed. I received the package containing the brass rod and other material yesterday. By your attention in this matter you have made me a sincere friend and a booster for your company. To show you the value of a good recommendation, I will say that it was the recommendation from a fellow-experimenter that induced me to send this order of mine to you. So I will recommend your company to all my friends.

From Wesley Gibbs, Rochester, N. Y.
Dear Sirs: In the morning mail of June 29th I received your postal saying that the articles which I ordered had been sent. I received them in the afternoon. This was the promptest shipment I have ever had. I am pleased with the order.

From Albert A. Munch, Pittsburg, Pa.
Gentlemen: Just a few lines to express my gratitude for the way you handled my order. I have dealt with quite a few wireless concerns, but only one has come up to your standard, and none above it. I wrote you a card on receipt of the Insulators and Guy Wire asking you to rush the remainder of the shipment through and I was astounded when I found the Wire and the other Insulator upon my arrival home. I am sure if the amateurs would place one order with you, they would be your steady customers. Thanking you again for Electro-Set Service, and hoping to have an order for you in the near future, I am.

From Leonard Bambauer, Erie, Pa.
Gentlemen: I sent for a receiver last Monday and received it last Thursday. I found same very satisfactory and I indorse your goods very highly.

From Richard Klerk, Jr., New York City.
Dear Sirs: I will recommend your company in every way possible for its promptness and efficiency of material.

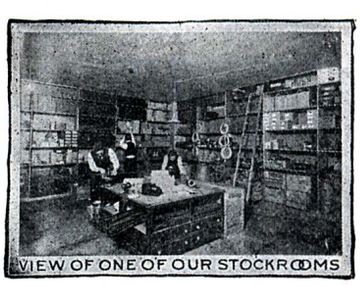
THESE BRIGHT EFFICIENT QUARTERS ENABLE US TO TAKE CARE OF YOU

MAILING AND EXPRESS ROOM

CATALOG DEPARTMENT

A VIEW OF OUR RETAIL STORE

MAIL ORDER OFFICES


VIEW OF ONE OF OUR STOCKROOMS

HAVE YOU TRIED THE ELECTRO-SET CO. YET?

HERE'S THAT BIG Handy Book and Catalogue

And the fascinating "STORY OF RED HEAD RECEIVERS"

Everybody that's interested in Electrical things needs these books.

Our Handy Book and Catalogue is the finest thing of its kind published. It contains many pages of invaluable experimental information, tables, formulas, facts, figures and instructions on electrical and wireless things.

128 Pages of Interesting Reading

Describing hundreds of electrical instruments, wireless goods, motors, toys, selenium cells, flashlights, raw materials, parts, chemical sets, telegraphs, bells, trains, lights, etc., all at lowest prices.

Each Book Costs Us 16c to Publish

We therefor ask that you send us 10c in stamps or coin for your copy—just to show that you're actually interested—and also to partly defray the tremendous cost of thisbook. Positively no catalogue sent without this trifling remittance.

Free—The wonderful story of Red Head Wireless Receivers. Tells all about these superfine phones and how you can try them 5 days without risk. Sent with each copy of our Handy Book. **SEND TODAY**

RED HEAD WIRELESS RECEIVERS

THE LAST WORD IN SENSITIVENESS

By actual test they are from 10 to 27 points more sensitive than any other standard make. A great New York Testing Engineer reports highly in favor of Red Head Receivers. You take no risk! 5 days' trial—and then if they do not fill every expectation we send your money back.

PRICES

2000 ohms, per pair, complete set, with head band and cord.....**$5.00**
1000 ohms, single receiver only..... **1.75**
1000 ohms, single set, with cord and band **3.00**

Send for our Free Booklet before buying wireless receivers

BIG TRIAL OFFER

To "Experimenter" Readers

For the purpose of further introducing our already widely known super-sensitive Triple A Grade Wireless Minerals, we offer for a limited time only this trial size package of A A A

10c **GALENA** postpaid anywhere in the world upon receipt of 10c in stamps or coin

Nearly all serious wireless experimenters are familiar with our wonderful wireless minerals. Hundreds of testimonials prove our contention that **no minerals marketed today can compare in sensitiveness to our standardized grades.** We make an unlimited guarantee that obviates all risk—**Your money back if you are not satisfied.**

Send today for this trial package of Famous Electroset Galena. **If you do not find more sensitive spots in this small trial package than you can get out of 8 oz. of ordinary galena, we will gladly return your dime.**

NOTE: Do not confuse this offer with our regular Arlington Tested Individually Packed Galena at 25c postpaid. Arlington Tested Galena will be sent if requested upon receipt of 25c in stamps or coin.

Arlington Galena is individually tested for extreme distances and is ultra-super-sensitive.

Send For The Bargain Trial Galena Today

THE ELECTRO-SET CO.

ADDRESS DEPT. E-G CLEVELAND, OHIO

ELECTRICAL THINGS FOR EVERYBODY

It Stands This Test!

YOU can short-circuit a THORDARSON Wireless Transformer right at the secondary terminals *for fifteen minutes* without damaging the transformer in the least. In fact, this is a regular test in the Thordarson laboratories.

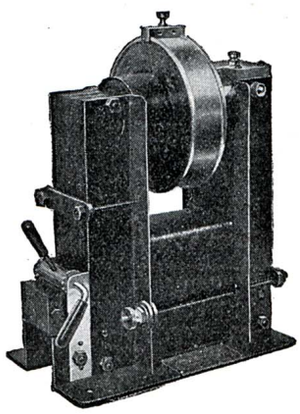
We do not know of any other transformer that will successfully withstand such an ordeal. It proves convincingly the quality that is *built into* the construction of

THE NEW
THORDARSON
WIRELESS TRANSFORMER

A new, perfected design—surpassing in range and flexibility our former models, with which operators have reported transmitting *1200 miles and over*

The Variable Shunt—an exclusive Thordarson feature—allows even greater flexibility than formerly. Locks in any position. New Ampere Scale accurately gauges the radiation.

The new THORDARSON is very strongly built, of pressed steel, without a single casting. Comes completely assembled—no chance for mistakes or burn-outs. In five sizes, from ½ to 2½ kw., 10,000—20,000 volts, any cycle desired.



Write today for full details and prices

Made by the Builders of the 1,000,000-volt Transformer at the San Francisco Fair.

Thordarson Electric Mfg. Co., 506 SO. JEFFERSON STREET CHICAGO, ILL.

LENZITE WIRELESS DETECTOR

Patented May 2nd, 1916

TRADE-MARK LENZITE

Price:

Detector complete

$5.00

Recognized by leading authorities as the most sensitive and most effective Detector existing. If not satisfied, return same and money will be refunded.

Our patent protects us and we protect you.

Write for booklet and further information to

LENZITE CRYSTAL CORPORATION

537 Chamber of Commerce Building **Pasadena, California**

QUESTION BOX.

(*Continued from page 516*)

we get:—

$$L = \frac{1.26 \times (400)^2 \times 1500 \times 300}{10^8 \times 60}$$

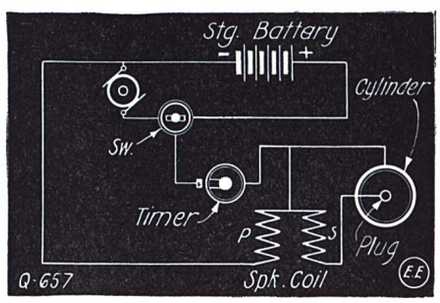
Hence L=15.1 henries.

Q. 2. How would you connect two lead-aluminum, electrolytic rectifiers with a transformer for doubling the fundamental frequency supplying the transformer?

A. 2. The diagram gives the connections you desire. It should be remembered that the oscillating circuit must be tuned to twice the fundamental. so as to bring the primary and secondary into a resonant condition.

Q. 3. What efficiency would I obtain from such an arrangement?

A. 3. About 45 per cent at the most.



Hook-Up for Jump Spark Ignition Coil on Gasolene Engine, Operating on Either Dynamo or Storage Battery.

IGNITION COIL CONNECTIONS.

(657.) L. Kintoes, Sitka, Alaska, wishes:

Q. 1. A wiring diagram showing how a dynamo and storage battery are connected for ignition.

A. 1. The diagram below shows the connections.

Q. 2. Why is oil employed on top of the solution of a copper oxide primary battery?

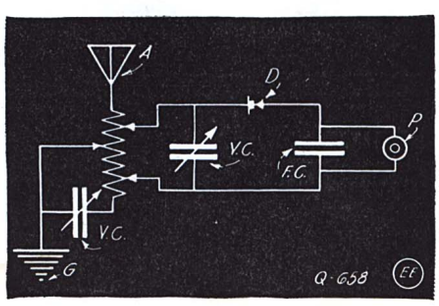
A. 2. The oil keeps outside dirt particles from entering the active electrolyte and prevents creeping of the battery salts. All copper oxide batteries use caustic potash, or caustic soda as an electrolyte. If the oil did not shut it off from the atmosphere, the solution would spoil in a few hours.

STEP-DOWN TRANSFORMER DATA.

(658.) Clarke Olney, East Cleveland, Ohio, asks:

Q. 1. Is there any way of hooking up two or three single or double slide tuning coils so as to make them as efficient as a loose coupler?

A. 1. The diagram herewith shows how to connect a three slide tuner so as to give results equal to that of a loose coupler as far as tuning is concerned.



Efficient Connection for Three Slide Tuning Coil in Radio Receiving Circuit.

Q. 2. If so, would the wave length of the above be the combined wave length of the included coils?

A. 2. Yes. The wave length would depend also upon the size of the coils and upon the shunt capacities therein.

Q. 3. Please give specifications for a small closed core transformer to reduce 110 volts A.C. to about 8 or 10 volts A.C.

A. 3. The primary winding should consist of 500 turns of No. 36 insulated magnet wire. The secondary is wound with 40 turns of No. 16 wire. The iron circuit is made of laminated iron sheets of No. 21 B. & S. gauge and it should measure 5"x3" outside. The windings should be properly insulated from the core.

MICROPHONE.

(659.) R. M. Jenkin, Wellington, New Zealand, wishes to know:

Q. 1. What sort of microphone and relay would be most suitable for working surprise stunts, such as opening a door by merely speaking to it. Also where he could obtain such an instrument and the price.

A. 1. In this kind of work it is necessary to employ a detectaphone transmitter. This can be obtained from the Micropho-Detector Co., 119 Nassau Street, New York City.

COAL TAR.

660.) P. Fisher, New York, N.Y., asks:

Q. 1. What are the operations for making coal tar?

A. 1. Due to lack of space, it is impossible for us to enter into details as to the making of coal tar. The usual procedure is to place into a closed crucible a quantity of soft coal and it is heated until the coal tar starts to flow. This is drained from the bottom of the crucible by a suitable valve cock. The cover of the receptacle is fitted with an opening for permitting the gases to escape. These are very important factors, as most of the gasoline, benzine, naptha, etc., is removed from the gases after they have been properly condensed.

SIZE OF CONDUCTORS VS. VOLTAGE.

(661.) P. Hallweck, San Francisco, California, wishes to know:

Q. 1. What is the relation between the cross-sectional area of electrical conductors and the voltage?

A. 1. The cross-sectional area of a given conductor varies inversely with the voltage.

Q. 2. Is there any advantage in employing an alternating current arc for radiotelephony instead of a direct current arc?

A. 2. Very little can be said about the alternating current arc as a generator for sustained waves, as but little has been done in this direction. It may, however, be stated that the arc starts oscillating much more efficiently, but we cannot tell off hand as to whether it proves to be more so when based on high power units. The subject is still open for research.

Q. 3. Describe the rotary field type of induction instrument.

A. 3. The parts are arranged similar to those of watt meters, the necessary split phase being produced by dividing the current into two circuits; one of which is inductive and the other non-inductive.

MOTOR QUERIES.

(662.) L. Jackson, Indiana, wants to know:

Q. 1. Some of the advantages and disadvantages of series motors.

A. 1. They are easily started, even under heavy loads. The winding is cheaper than the other types and the speed is nearer constant than shunt motors when operated on constant current circuits. When used on constant pressure circuits such as those employed for incandescent lighting, the speed will depend on the load. On no load they tend to race and will, if not watched, tear themselves to pieces.

Q. 2. In the operation of a motor what is the nature of the reverse E.M.F. (counter electromotive force)?

SUPERIOR MIGNON SYSTEM RADIO APPARATUS

EFFICIENT EQUIPMENTS FOR ALL PURPOSES

MIGNON-SYSTEM RADIO-APPARATUS

MIGNON WIRELESS CORPORATION ELMIRA, N.Y. U.S.A.

DAMPED & CONTINUOUS WAVES

WRITE FOR CATALOGUE AND MENTION THE ELECTRICAL EXPERIMENTER

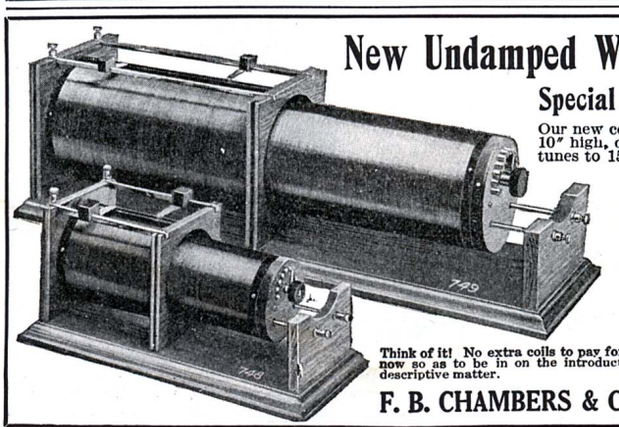
Watch for LATEST MIGNON INVENTION *in Electrical Experimenter*

Mignon Adjustable Disc Core Undamped Wave Receptors

RW 1, RW 2 and RW 3

THE LAST WORD IN RADIO ENGINEERING

ELMIRA, N. Y., U. S. A.



New Undamped Wave Coupler No. 749

Special Introductory Price, $18.00

Our new coupler No. 749 is 32" long, 9" wide, and 10" high, over all, and on an average-sized Antenna tunes to 15,000 meters. This coupler, used with the new CHAMBERS' SYSTEM or CIRCUIT, will bring in signals from domestic and foreign Arc Stations surprisingly loud and clear. Note the difference in size of our No. 748 and No. 749.

We claim to be the original inventors of a SYSTEM or CIRCUIT for the reception of the undamped waves without the use of Loading Coils or Oscillating Coils, as they are sometimes called; as with our SYSTEM or CIRCUIT only two Inductively Coupled Coils are necessary. Circuit supplied with each coupler.

This CHAMBERS' CIRCUIT saves you money.

Think of it! No extra coils to pay for, and price of coupler only $18.00. Place order now so as to be in on the introductory price. Orders filled in rotation. Send for descriptive matter.

F. B. CHAMBERS & CO., 2046 Arch St., Phila., Pa.

Things You Need

We list below a few of the many parts shown in our Catalog E, which every experimenter will find use for.

KNOBS

5/32" Hole
No. 606....Price $.20
Doz. $2.00

8-32 Bushing
No. 601....Price $.04
Doz. $.40

BRASS SWITCH POINTS

		Doz.	50	100
¼"x¼" 6-32	No. 628	.30	.90	1.50
¼"x ⅜" 6-32	No. 626	.30	1.00	1.75
¼"x¼" ½"—6-32	No. 627	.36	1.25	2.00

NICKELED SWITCH POINTS
50% ADVANCE

We Make PROMPT SHIPMENTS on all of the above listed material.

POSTAGE ON ALL APPARATUS EXTRA

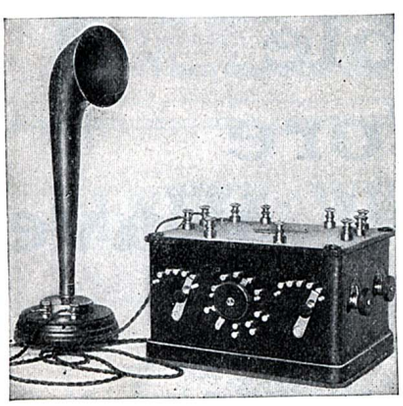
MAGUIRE & SHOTTON
Albany, N. Y.

KNOBS

8-32 Bushing
No. 602....Price $.10
Doz. $1.00

10-32 Bushing
No. 608....Price $.05
Doz. $.50

Two-Step Multi-Audi-Fone



You don't know what wireless signals are until you have heard a Two-Step M. A. F.

Price $75.00

SEND FOR NEW CIRCULAR

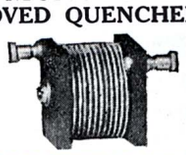
Multi-Audi-Fone	$18.00
With Special Head Set	23.00
Pocket Wireless Receiving Set	5.75
M.A.F. Detector Stand	4.25
M.A.F. Fixed Condenser	2.00
Un-Damped-Waver	45.00 & 100.00
Detector Fone	35.00

MULTI-AUDI-FONE 275 MORRIS AVENUE ELIZABETH, N. J.

THE NEW TUBULAR MICA CONDENSER

Composed of a special mica possessing infinitesimal leakage. Its efficiency permits use across your tuners in place of massive load coils, to raise wave. Use in place of your present fixed condenser and note quality of tone and amplification. Made in two capacities, one capacity for grid of audions and tubular detectors, and one for crystal detectors. Individual capacity marked on same, tested from standard furnished by Bureau of Standards. Specify purpose. A high efficiency, beautifully finished permanent condenser, guaranteed. **Postpaid $2.50 Each.**

MONOTONE IMPROVED QUENCHED GAP



Are you a leader or follower in adopting up-to-the-minute efficient apparatus? Equip your station with the famous MONOTONE IMPROVED QUENCHED GAPS, which are a big improvement over the original MONOTONE GAP. Span that freak distance on powerful waves of RADIO ENERGY. Each plate carefully machined. Best mica. Adjustable. One unit of the new gap for spark coils up to 3". One unit for every ¼ K.W. power of transformer. Specially recommended for powers below ½ K.W. Parts nickled and polished. You will be pleased with this new gap. Guaranteed. **Postpaid $2.50 Each.**

THE RICHARDSON CO., Manufacturers of Radio Apparatus **ERIE, PA.**

A. 2. It is proportional to the velocity of rotation, the strength of the magnets and to the number and arrangement of the wires on the armature; that is, the reverse voltage depends on the rate at which the lines of force are cut.

Q. 3. How may the rotation of a motor be reversed?

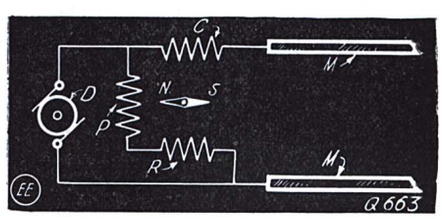
A. 3. By reversing either the current through the fields, or the current through the armature.

OHMMETER.

(663.) Pondy Elk, Pennsylvania, writes:

Q. 1. What is an ohmmeter?

A. 1. It is an instrument for measuring resistances directly where it is desirable to test with a high voltage. It consists of two parts, namely, a small hand dynamo capable of generating 100 volts or more, and the instrument proper. The latter has two coils mounted at right angles to each other and a magnetic needle, which takes a certain position between the two coils, according to the relative currents in the coils. One coil is connected between the dynamo and one terminal of the circuit whose resistance is to be measured. The other coil is connected in series with a high resistance inside the instrument so as to form a shunt across the main circuit, as shown in the figure. When the dynamo is operated, the current divides, part going through the coil C and then through the main circuit, whose resistance is to be measured, while the remainder goes through the coil P and the high resistance R. The currents through the two coils are inversely proportional to the resistances in their circuits



Circuits of Direct Reading Ohmmeter of the "Megger" Type.

since the same voltage is applied to both, and therefore they attract the needle, correspondingly. For a given voltage of the dynamo, the attraction of the coil P is constant, while the attraction of coil C becomes greater as the resistance in the main line becomes less. The pointer attached to the needle will, therefore, move towards C, as the resistance in the line becomes less and the scale may be divided to indicate the resistance in the main circuit.

Q. 2. For what ranges of resistance is the ohmmeter suitable?

A. 2. It will measure resistances from about 5 megohms (5,000,000 ohms) down to about 1,000 ohms. It is suitable in measuring the resistances of cable insulation, etc., besides many other things.

NAVY COUPLER.

(664.) Sigmund Schmeltzer, New York, wants:

Q. 1. Information on how to build the Navy type loose coupler.

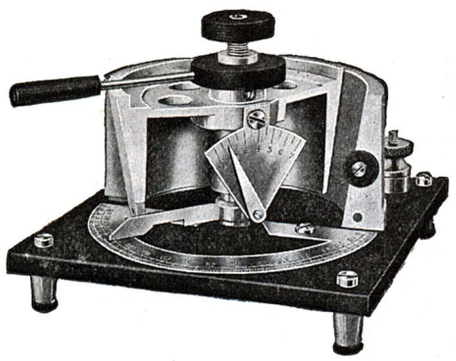
A. 1. We would refer you to the September, 1915, issue of THE ELECTRICAL EXPERIMENTER for information concerning the construction of a Navy type inductive coupler. Full details are there given on a separate blue-print supplement showing its construction. If you do not possess this copy, we can supply you with one for fifteen cents postpaid.

Q. 2. I would like to know what instruments to use in order to receive NAA. I have an aerial sixty feet long, composed of four wires, separated a foot and a half

(*Continued on page 522*)

TURNEY VARIO VARIABLE CONDENSER

MICRO ADJUSTMENT



SEVEN IN ONE

DIMENSIONS 6"x6"x3" SHIPPING WEIGHT 2 LBS.

SCALE READINGS

Scale No. 1-0 to .001 M.F. Scale No. 4-0 to .00012 M.F.
Scale No. 2-0 to .0005 " Scale No. 5-0 to .00007 "
Scale No. 3-0 to .00025 " Scale No. 6-0 to .000055 "
Scale No. 7-0 to .000035 M.F.

Price $8.00 POSTAGE EXTRA

The new TURNEY VARIO VARIABLE CONDENSER is ideal for EXTREME MEASUREMENTS where absolute accuracy is demanded. It is incomparable for WAVE METERS and Regenerative Ionized Gas and pure Electron Detector circuits. The entire instrument (with the exception of the base which is of Bakelite) is engine turned and is made with the greatest care. Don't buy a Condenser until you have seen the TURNEY VARIO VARIABLE.

THE NEW TURNEY HEAD SET

With Adjustable Pressure Head Band.

REAL COMFORT

ULTRA SENSITIVE

PATENT APPLIED FOR

Price $7.50 MAILING WEIGHT ONE POUND

DESCRIPTION — 3000 Ohms, positive friction adjustments which stay put. Bakelite ear caps, German silver top band, lenient back check, consequent poles, and like all Turney apparatus is extremely handsome in appearance. The adjustable pressure head band affords real comfort no matter how long you wear it. NOTICE—All Turney head sets will be provided with the lenient back check that consists of a special woven canvas strap which fits the head perfectly.

A circular containing full information will be furnished on request

Eugene T. Turney Company, Inc., 2595 Third Avenue NEW YORK CITY

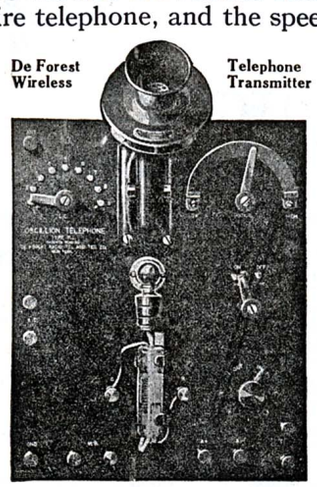
THE WIRELESS TELEPHONE

Do you realize that a thoroughly practical **Wireless Telephone** simple enough to be used by anyone has been produced?

A GREATER INVENTION THAN WIRELESS TELEGRAPHY

You don't have to be an operator to use the new **De Forest Radio Telephone Transmitter.** Anyone can talk over it the same as over the wire telephone, and the speech is *clear and distinct* and free from all metallic noises.

De Forest Wireless Telephone Transmitter



APPLICATIONS

For yachts, house boats, barges, commercial ships, tugs, lighters, power transmission companies, railroads, mining camps, logging operations, lumber camps, insular communication, farm service and a thousand other uses, where a practical, dependable telephone is a necessity.

COST

For one complete station comprising transmitter, receiving outfit, Motor Generator and all accessories,

$325.00

We offer radio telephone sets to cover from 1 to 150 miles, either transmitting sets alone or complete stations

ADVANTAGES { LOW INITIAL COST, LOW OPERATING COST, THOROUGH RELIABILITY
CLEAR DISTINCT SPEECH, NO SPECIAL OPERATOR REQUIRED.

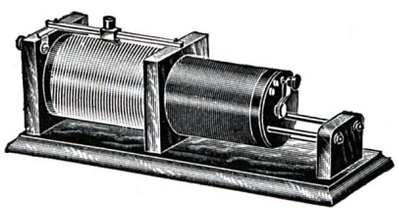
Enclose stamp for new bulletin F.16 on oscillion type Radio Telephones

DE FOREST RADIO TELEPHONE & TELEGRAPH CO.

101 PARK AVENUE ***Makers of the Highest Grade Receiving Equipment in the World*** **NEW YORK, N. Y.**

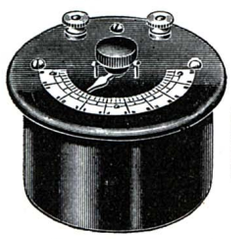
"Preparedness"

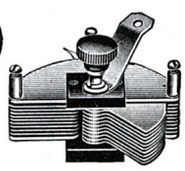
In War or Peace Use Bunnell Apparatus



No. 8833 Dandy Loose Coupler $6.00

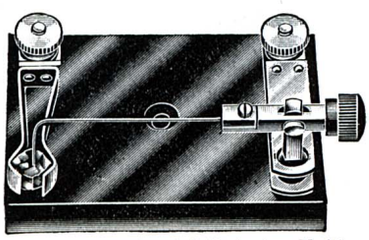
Best and most durable. Up-to-date dealers have them in stock.





No. 8654 Dandy 21 Plate Variable Condenser $3.75

Our Catalog 36E illustrates and describes about 300 articles of wireless apparatus as well as other appliances. Send 2c. stamp for it, to



No. 8804 Jove Crystal Detector Holder
On Dark Porcelain Base . . . $1.25
On Handsome Composition Base . . . 1.50

J. H. Bunnell & Co.'s
Radio Dept.
32 Park Place New York

Holtzer-Cabot

RADIO RECEIVING TELEPHONES

Pronounced by experienced operators to be the most sensitive phones on the market to-day

You *get* the *faint signals* when you use the genuine **Holtzer-Cabot** phones.

You get the very essence of comfort too. They fit the head perfectly and weigh complete only 10½ ounces.

SATISFACTION GUARANTEED OR YOUR MONEY BACK

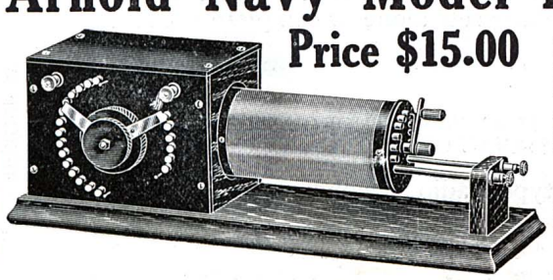
Send for Booklet 1687X

THE HOLTZER-CABOT ELECTRIC CO.
BOSTON, MASS.
6161-65 SO. STATE ST. CHICAGO
101 PARK AVENUE, NEW YORK
1104 UNION TRUST BLDG. BALTIMORE

SEE OUR BIG SUBSCRIPTION OFFERS ON PAGES 541 AND 542

Arnold Navy Model Loose Coupler

Price $15.00



A customer said the other day: "Arnold, I have seen your Ad. in the magazine for months and had I known the instrument was as good as it is and looked so much better than the Cut I would have bought one sooner. I am glad I came to town and had a chance to take one in hand and see for myself."

Needless to say he bought one.

I also carry the finest line of Switches, Switch Points, Cabinets and Accessories on the market.

Send 2c stamp for Bulletin No. 3

Please Note NEW ADDRESS

J. F. ARNOLD, 327 East 119th Street, New York

QUESTION BOX.

(*Continued from page 520*)

apart. My aerial is about seventy-five feet high.

A. 2. The following instruments will be required: A 3,000 meter inductive coupler, loading coil, 2 variable condensers, fixed condenser, crystal or vacuum detector; if former we advise you to employ Radiocite for the crystal and a pair of 2,000 ohm telephone receivers.

A. C. QUERIES.

(665.) A. Goldman, Richmond, Virginia, wants to know:

Q. 1. How can the frequency of an alternating current be calculated?

A. 1. The frequency in cycles per second equals one-half the number of field poles on the alternator, multiplied by the number of revolutions per second of the rotor.

Q. 2. How are two phase currents obtained?

A. 2. One method is by the use of four collecting rings connected with four points on a direct current commutator; one pair being connected to points directly under brushes of opposite polarity; the other pair being connected to points midway between these. Another method is to couple the armature shafts of two similar alternator armatures together so that the electro-motive-force of one is a maximum at the same instant that the E.M.F. of the other is at the zero. The more usual method for commercial work is to use a regular 2-phase alternator, wound for the purpose and having either four or three slip rings.

Q. 3. What prevents an enormous current from passing through the primary coil of a transformer and burning it out?

A. 3. The small alternating current that passes through the primary coil magnetizes the iron core, first in one direction and then in the other. This rapid magnetization and demagnetization means that the number of magnetic lines of force threading through the iron core inside the coils is continually changing. Viewed from a slightly different standpoint, it means that lines of magnetic force are continually crossing the coils, or that the coils are continually being cut by the lines of force. The result is the same from either standpoint, the changing magnetizations of the iron core causing the generation of E.M.F. in the coils surrounding the iron. The E.M.F. thus induced in the secondary coil causes a current to flow in the secondary circuit. Likewise the E.M.F. similarly induced in the primary coil tends to send current through the primary circuit in opposition to the original current. Thus the E.M.F. induced in the primary coil acts as a counter electro-motive-force and opposing the impressed voltage on the primary circuit, thus holding back the primary current.

ACTION OF WIRELESS WAVES.

Ever since the extensive commercial employment of wireless telegraphy, there have been many who believe that the powerful Hertzian waves seriously affect organic life. In fact, some have even suggested that laws or regulations should be enacted to protect organic life against wireless waves. With a view to determining the extent and nature of the radio waves' influence on organic life and climate, Dr. C. Abel-Musgrave recently asked several questions on the subject to be answered by a number of prominent scientists. The summary of their answers was that wireless waves have no influence on organic life, nor do they alter climatic conditions, although it is true that certain electrical stresses are capable of accelerating rainfalls.

Electric flat irons are rapidly replacing hand and gas irons in English tailor shops.

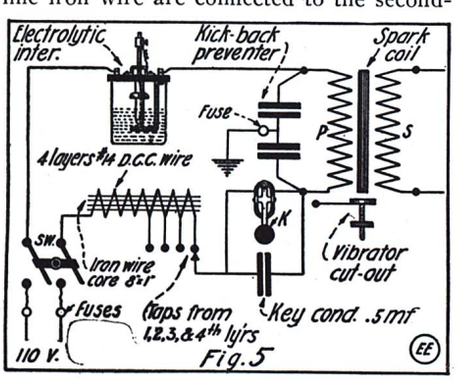
THE HOW AND WHY OF RADIO APPARATUS.

(*Continued from page 493*)

on reflection it will be evident that when the primary circuit is open the primary current magnetic flux is collapsing and in doing so the flux lines are caused to cut the secondary turns in a direction opposite to that at *make* of the circuit. Figs. 2 and 3 will make this quite clear, as the expanding and contracting lines of force are clearly shown therein.

From this discussion, as well as from the illustration given in Fig. 4, it becomes evident that in the ordinary induction coil, in the medical coil for instance, a pulsating direct current passing through the primary winding is transformed into an unsymmetrical, alternating current in the secondary winding; the half waves of which are not harmonious. In the spark coil, however, where the secondary potential is sufficient to create a disruptive spark, the direct current passing in the primary is transformed into an unsymmetrical, alternating current in the secondary only, when the spark gap is sufficiently short to allow the weaker, or inverse half wave B, of the current to jump it. If the gap is too long for the B half wave to leap across it, then the secondary current is practically a undirectional one.

It is possible to test the polarity of the secondary terminals by means of pole test paper or also a standard, liquid polarity indicator may be utilized. If two pieces of fine iron wire are connected to the secondary terminals of the spark coil, one of them will become very hot and the other will remain cold; the cold one being the positive terminal of the coil.



Proper Connections for Small Spark Coil with Electrolytic Interrupter on 110-Volt Circuit.

As shown by the oscillogram Fig 4, which is that for a small spark coil fitted with a vibrator shunt condenser, the duration of the primary current at the *break* of the interrupter is quite short. The duration of this portion of the primary current is kept as short as possible, and aided in so doing, to a large extent, by the condenser shunted across the vibrator. This condenser absorbs the extra or self-induced current of the primary, which would otherwise unduly prolong the demagnetization of the iron core. The general wave form of the primary current, and sensibly also its potential, is similar to that shown at Fig. 4. When the interrupter closes the primary circuit, the primary current rises slowly to a maximum and at the rupture at the interrupter, the primary current and potential fall quite rapidly to zero. The quicker the break of the interrupter and the faster the demagnetization of the iron core, the more pronounced the intensity or potential of the secondary induced wave, A. This is shown graphically, and in a striking manner, by the oscillogram.

Small spark coils may be operated in the regular way from A.C. step-down transformers. Where 110 volts A.C. or D.C. is available it is a good idea to operate the spark coil with an electrolytic interrupter;

BUILD YOUR OWN DETECTOR

We can furnish you with high-grade parts at bargain prices. See our previous advertisements, or send for catalog—it's ready now—no postage needed.

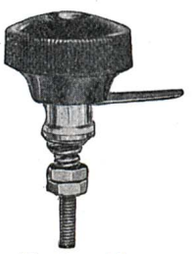
Dealers and Jobbers—Write for our Profit-Making Proposition

Equip Your Sets with **INDESTRUCTO Potentiometer Controls**

AudioTron Potentiometer and Rheostat Units are made of a special uniform composition and are designed to give silent, easy and close adjustment of battery potentials by a constant and gradual increase not possible with one cell variation. This results in maximum sensitiveness. The B battery unit is of 7000 ohms resistance, insuring long life to the batteries. Any lower resistance wastes your battery. The AudioTron Indestructo Filament Rheostat, having no wires to corrode, lasts a lifetime. Its ease of adjustment is also a big feature, and it adds to the appearance of your set.

B Battery Potentiometer Unit

B Battery Potentiometer complete	**$1.00**
Less Lever and Knob	**.50**
Filament Rheostat complete	**1.50**
Less Lever and Knob	**1.00**
Lever and Knob	**.50**



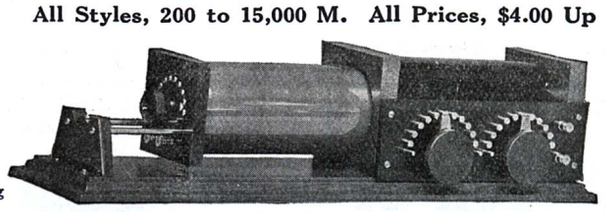
Knob and Lever

Largest Line of Loose Couplers on the Market

All Styles, 200 to 15,000 M. All Prices, $4.00 Up

Junior
Amateur
Standard
Types

Send for catalog



AudioTron, Navy Type, Loose Coupler

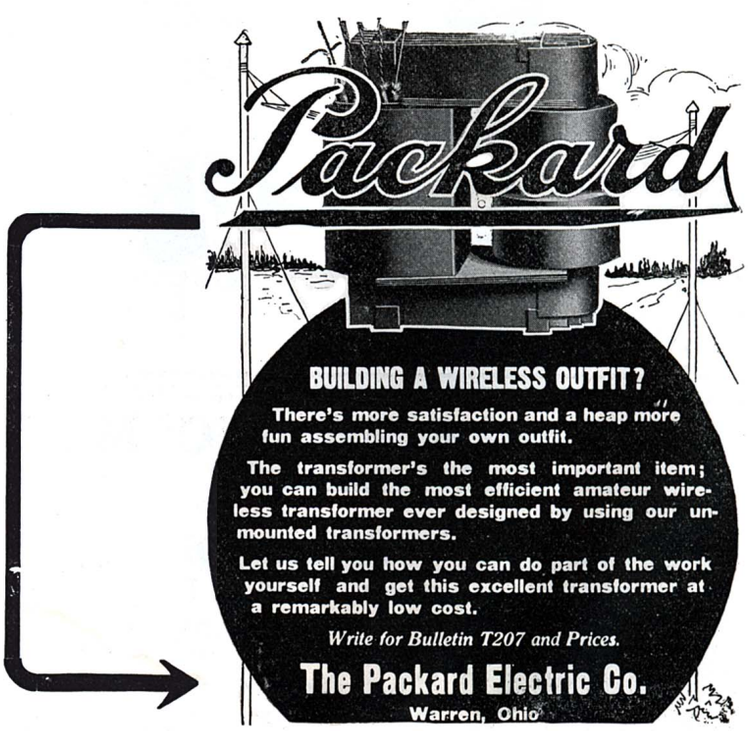
Commercial
Dead-Ending
Ultra
Types

Send for catalog

WATCH OUR NEXT ANNOUNCEMENT
ON A
SUPER-SENSITIVE DETECTOR

TERMS: Always Transportation Prepaid, Satisfaction Guaranteed, Cash

AUDIOTRON SALES CO., 315 Lick Building, San Francisco


Packard
BUILDING A WIRELESS OUTFIT?
There's more satisfaction and a heap more fun assembling your own outfit.
The transformer's the most important item; you can build the most efficient amateur wireless transformer ever designed by using our unmounted transformers.
Let us tell you how you can do part of the work yourself and get this excellent transformer at a remarkably low cost.
Write for Bulletin T207 and Prices.
The Packard Electric Co.
Warren, Ohio

6WT8

EXPERIMENTERS!

Save money by buying a GOOD storage battery FIRST. The ONE thing you can't afford to experiment with is a storage battery.

Marko Storage Batteries are especially adapted for operation of all kinds of spark coils, insuring a heavy and powerful spark. There is nothing superior

MARKO STORAGE BATTERIES

Marko GUARANTEED Storage Batteries are not experiments—they have been on the market for 10 years.

FOR AUDION USE

It is a well-known fact among up-to-date wireless engineers and experimenters that the Audion operates at a higher efficiency when controlled by a storage battery that gives constant voltage. Marko Batteries are designed to meet these conditions.

Guaranteed highest quality and lowest prices. Some Popular Sizes.

Type	Volts	Amp. H.R Capacity	List Price	Special price to wireless engineers
4C2	4	40	$ 7.00	$4.20
6C2	6	40	10.00	6.00
6C4	6	60	12.00	7.20
6C6	6	80	16.00	9.60

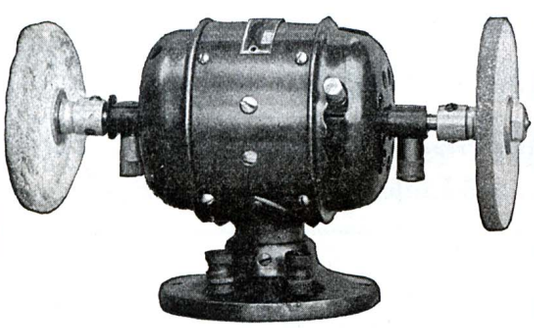
MARK O' QUALITY

STORAGE Marko BATTERY

PAUL M. MARKO, 1191 Bedford Ave., Brooklyn, N. Y. The Mark-o' Quality
New York Depot—974 8th Ave., New York City

THE MOTOR OF A HUNDRED USES

"National" Combination Universal Utility Motor



A Necessity for Home and Shop

Some of Its Uses

Rotary Spark Gap—Grinding—Polishing—Buffing—Running Sewing Machine—Small Lathe—Fan—Toys, etc.

Not a Toy But a Sturdy Dependable Motor

Variable speed 2000 to 6000 R.P.M. furnished to operate on any circuit AC. or DC.

Our Special Price complete with CARBORUNDUM WHEEL, POLISHING BUFFER AND TWO ARBORS. **$5.25** Fully Guaranteed Regular price $6.50

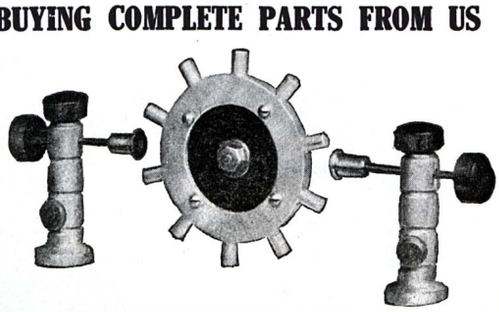
Build Your Own Rotary Spark Gap

YOU WILL SAVE MONEY BY BUYING COMPLETE PARTS FROM US

This illustrated set is the same as used on our "NATIONAL" HI-TONE GAP consisting of a highly polished aluminum rotor mounted on a genuine hard rubber disk ready to be affixed to the motor; two terminals also of polished aluminum equipped with hard rubber adjusting knobs and removable sparking points. High-class workmanship used, its appearance is very attractive. Can be used on spark coils or transformers up to 1 KW.

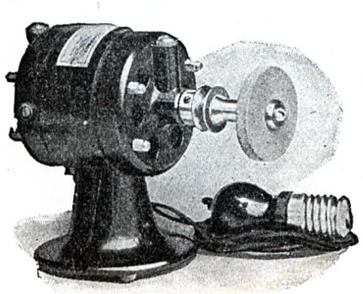
201 Set complete - - - - - - $4.50
202 Rotor complete - - - - - - 2.75
203 Stationary Terminal complete 1.00

SEND FOR CIRCULAR



National Electric Manufacturing Co.
2118 Mallers Bldg., Dept. 10 Chicago, Ill.

UNIVERSAL ELECTRIC MOTORS



Operating on A. C. or D. C.—110 to 130 volt
1/16 to 1/4 H. P.

THIS MOTOR 1/16 H. P. **$5.00** Complete

SPEED 6,000 R. P. M.

For spark gaps—grinding—polishing, etc.

Send Postage for Catalogue

OMEGA ELECTRIC COMPANY
304 So. Dearborn St. Chicago, Ill.

see Fig. 5. Small coils, such as the ½ or 1 inch variety, should not be hooked up direct to 110 volt circuits, but should have a suitable choke coil in series with the primary winding and the electrolytic interrupter. All such installations should, no matter how small, be equipped with a kick-back preventer of approved form. It is required in all cases by the Fire Underwriter's rules governing radio installations operating on commercial light and power circuits.

THE SPERRY 1,280,000,000 C.P. SEARCHLIGHT THROWS BEAM OVER 50 MILES.

(*Continued from page 484*)

crank carrying a crown gear, which engages a gear on the vertical shaft is used to rotate the carbon by hand if necessary.

The positive feed is operated by thermostatic control of powerful solenoids through the vertical shaft. The thermostat is mounted on the drum and so arranged that when the positive carbon burns out of the focal point of the mirror the light from its crater is brought on to the thermostat, causing feed of the positive carbon until the focal point is again reached. This automatic control of the positive carbon is also supplemented by hand control.

The feed of the negative carbon is controlled by a solenoid connected directly across the arc and moves the carbon in the proper direction as the voltage rises or falls. The automatic feed of the negative carbon is also supplemented by hand control. A striking solenoid moves the entire negative holder back the proper arc length on striking of the arc.

The entire negative carriage can be turned on the right to permit new negative carbons to be inserted; when so turned, the grip on the carbon is released slightly, permitting a new carbon to be slipped in easily.

The operation of the Sperry lamp is very steady and requires but very little attention after the simple adjustments for length of the arc, speed of rotation of the positive carbon, and the feeding of the carbons have been made. The positive carbon is inserted into the holder by slowly rotating it and pushing it forward at the same time.

A rheostat is used in series with the arc, adjusted so as to get a voltage across the arc of about 75 volts.

A very important advance in this work has been in the manufacture in this country of carbons suitable for such searchlight arcs. Formerly the only source of supply of carbons suitable for these results was Germany, but after many months of research work it is now possible to manufacture superior carbons for this purpose in this country.

Searchlights of 24, 30 and 60-inch diameter of the Sperry type are being built. In addition, the Sperry lamps are being installed in old searchlights replacing the old form of arc.

EXPERIMENTAL CHEMISTRY.

(*Continued from page 502*)

placed on top of it, to prevent it from overturning.]

[Note:—The Manganese Dioxide was used with the Potassium Chlorate as a catalytic agent. The properties of this compound were not changed, this substance being used to help the reaction along.]

The reaction which took place in the preparation of oxygen from Potassium Chlorate and Manganese Dioxide, was as follows: (A)

$$\underset{\text{[Potassium Chlorate]}}{2KClO_3} + \underset{\text{[Manganese Dioxide]}}{MnO_2} = \underset{\text{[Potassium Chloride]}}{2KCl} + \underset{\text{[Manganese Dioxide]}}{MnO_2} + \underset{\text{[Oxygen]}}{3O_2}$$

Another method of writing this equation is as follows:

(B) $2KClO_3 = 2KCl + 3O_2$
[Potassium Chlorate] = [Potassium Chloride] + [Oxygen.]

It is shown by the equation (A) that the Manganese Dioxide was not altered by the reaction.

ACTION OF BURNING WOOD IN OXYGEN.

Experiment No. 17—

Take one of the bottles of Oxygen, and while the glass plate is in position over the mouth, slide the plate slightly to one side of the bottle, just enough to admit a small piece of wood, as round as a match. Light this thin piece of wood, and while there is still a glow on the tip [*but no flame*], thrust it into the bottle, and notice the result. Try this over two or three times. Cover the bottle with a glass plate after burning the splint in it.

The following experiment to test for the product of wood burning in oxygen can be made.

Experiment No. 18—

Pour into the bottle about 10 or 15 cc., of Limewater [Calcium Hydroxide] [Ca $[OH]_2$], and close the mouth of the bottle with either a cork, or the palm of your hand, then shake the contents, and pour into a test tube for examination.

ACTION OF CHARCOAL BURNING IN OXYGEN.

Experiment No. 19—

Obtain a small piece of charcoal [about ½x½ inch] and place in a combustion spoon, or forceps, and hold in the flame of the Bunsen burner, until it has a bright glow. Then thrust it into the Oxygen [a different bottle than used in Experiment No. 17 or 18] in the same manner as Experiment No. 17. Notice what action has taken place.

ACTION OF MAGNESIUM WITH OXYGEN.

Experiment No. 20—

Take another bottle of Oxygen, and set it on the work table ready for instant use, as soon as the magnesium is ignited. Take a piece of Magnesium Ribbon about 1 or 2 inches long, and hold tightly with a pair of forceps as shown in Fig. No. 30-31, then ignite the end of the ribbon, and thrust it immediately in the jar of oxygen. Observe the action which takes place. [Note:—The Magnesium Ribbon must be thrust into the jar as soon as it is lit, otherwise it will burn up before you have a chance to place it in the jar.]

BURNING IRON IN OXYGEN.

Experiment No. 21—

In this experiment a large bottle is required, and about 1 inch of water in the bottom of the bottle to prevent it from breaking.

Have a piece of stranded picture wire about 2 inches long, and hold it with a pair of forceps. Heat the wire to a red glow and dip it while hot, into some powdered sulphur. As soon as the sulphur starts to burn, thrust it into a jar of oxygen in the same manner as in Experiment No. 17, and watch and record any action which takes place. If no change is observed, repeat the operation.

[Note:—It is necessary to use different jars of oxygen, for all the experiments mentioned above. Do not try two or more experiments in the same bottle of oxygen.]

In the foregoing experiments we have burned certain substances in the gas Oxygen. Let us compare the difference in the burning of these substances both in Air and Oxygen.

In the case of the splint of wood, we know that before it was burned in oxygen, it had only a faint glow, almost ready to go out. After it was thrust in the oxygen it immediately burst into flame.

In the case of charcoal, it was similar to

Just Like the Big Trains

I Go right down into the great railroad yards and study the latest style of locomotives, cars and semaphores. Then I pattern Lionel Electric Trains after them. Buy Lionel trains and you have *REAL TRAINS,* only smaller in size.

You can buy Lionel trains from your dealer, complete or in single pieces, and think of this—there are so many different kinds of locomotives, passenger cars, freight cars, trolley cars, etc., that there is always something new when you want a change.

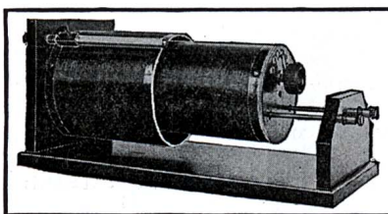
OH! YOU CHRISTMAS MAN!

Tell father Christmas will be a failure without a Lionel train. Then send for my big, free catalog showing the complete line with *over a hundred pictures.* Mark what you want, give it to father and urge him to order from your Lionel dealer. He *will!*

BOY'S CATALOG FREE

J. LIONEL COWEN, *Friend of the Boys*
President THE LIONEL MFG. CO.
48L EAST 21st STREET NEW YORK CITY

LIONEL TOYS ELECTRIC



This Loose-Coupler, $5.00, ALWAYS DEPENDABLE and withal inexpensive

Tuning to 2500 meter waves with suitable amateur aerial. Dimensions 14 inches long, 6 inches high, 6 inches wide. Shipping weight, 5 lbs. Fully described in bulletin No. 104. You will want our bulletins on Hi-Tone Transmitter, Oscillation Transformer, Variable Static Shunt, Amplifying Receivers, Rotary Motor, etc. A postal card will bring all these free, but tell us the particular one you are most interested in just now.

Radio Apparatus Co. of America, Parkway Building, Philadelphia

YOU Be the BOSS

Learn Electrical Meter Engineering

The Most Important Profession in the Electrical Industry

More Electrical Meter Engineers are needed. We must train them since ours is the only school in the world teaching Electrical Meter Engineering. A half million new Electric meters will be installed this year. Think of the demand for trained men! We have more calls for trained men now than we can supply. You can **Be the Boss**—qualify for the **Big Job**—right in your own home in a few short months. No previous experience necessary. Send the coupon for **Free** information.

EARN $1200 to $3000 A YEAR

Meter Engineers get Big Money. You can qualify. You can draw the Fat Pay Envelope. Write today. Get into this interesting, fascinating, profitable profession NOW while we are enjoying unparalleled prosperity. Send the coupon *today*, Be the man who fires—not the one who is fired—**Be the Boss.**

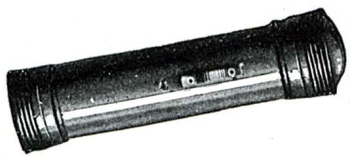
Fort Wayne Correspondence School, Dept. 338-C Fort Wayne, Ind.

Free Coupon

Gentlemen:—
Send me absolutely free full particulars of Meter Engineering.

Name.....
Address.....
.....

Fort Wayne Correspondence School 338-C Fort Wayne, Ind.



FLASHLIGHT SERVICE

Long-lasting, brilliant white light when and where you want it, without bother or danger—that's what you get when you buy a

Franco FRANCO Flashlight

Better flashlights simply *can't* be made. They were awarded highest honors at the Panama-Pacific Exposition. Every one is definitely guaranteed to give reliable service always. See that you get a genuine FRANCO FLASHLIGHT with a Radio Battery—and see for yourself how helpful they are. Made in many styles, selling at reasonable prices. Send for illustrated booklet.

INTERSTATE ELECTRIC NOVELTY COMPANY

104 S. 4th St., BROOKLYN, N.Y.

Chicago : San Francisco : Toronto

Make Your Own Electric Light!

We can furnish you with D. C. Generators and Motors from 80 watts to 1 K. W. Also finished parts for same. Free instructions to wind with every order. Transformers made to order. Send for catalog.

ALL AT FACTORY PRICES

All kinds of Electric Repairing. Commutators refilled a specialty.

BERGMANN MOTOR WORKS

442-446 Niagara Street Buffalo, N. Y.

the burning of the splint, namely it burned rapidly in oxygen.

In the case of Magnesium, it might have been hard to distinguish the difference between the glow in and out of the oxygen due to the brightness of the light.

In the case of iron wire, we know that we could not burn it in air. But it burned readily when we plunged it into the oxygen. If we could burn iron in the air as readily as in oxygen, the result to all iron stoves, iron vessels, iron buildings, iron ships, etc., is obvious.

THE COMBINATION OF A SUBSTANCE WITH OXYGEN.

From the experiments performed we know that when a piece of wood burns in oxygen, the wood becomes charred, and a black mass, with different properties, is left in place of the original wood. In Experiment No. 18 we performed a test to find out what the wood formed when burned in oxygen.

Wood, we know, is chiefly Carbon; then the reaction which took place between the wood and oxygen was as follows:

$$C + O = CO_2$$

[Carbon]+[Oxygen]=[Carbon Dioxide]

The product was carbon dioxide [CO_2], which proved its presence by the Limewater Test. The reaction which took place between the Carbon Dioxide and the Limewater was as follows:

$$CO_2 + Ca[OH]_2 = CaCO_3 + H_2O$$

[Carbon Dioxide]+[Calcium Hydroxide] = [Calcium Carbonate]+[Water]

The white precipitate which formed after shaking with limewater, being Calcium Carbonate [$CaCO_3$].

In the case of Magnesium, the product was Magnesium Oxide; the reaction being:

$$Mg + O = MgO$$

[Magnesium]+[Oxygen]=[Magnesium Oxide]

The iron was converted into Iron Tetroxide, the reaction being:

$$3Fe + O_4 = Fe_3O_4$$

[Iron] + [Oxygen] = [Iron Tetroxide]

Thus we find that when a substance burns in oxygen an OXIDE is formed, as shown by:

Wood = Carbon Dioxide [CO_2];
Magnesium = Magnesium Oxide [MgO];
Iron = Iron Tetroxide [Fe_3O_4];
Sulphur = Sulphur Dioxide [SO_2];
Phosphorus = Phosphorus Pentoxide [P_2O_5];
Zinc = Zinc Oxide [ZnO];

CHEMICAL DEFINITIONS.

Catalysis—Catalysis is a chemical action by which a substance exerts a chemical effect, and which undergoes no permanent change itself. The Manganese Dioxide as used together with Potassium Chlorate in the preparation of oxygen, is known as a CATALYTIC AGENT, or CATALIZER; and the process as CATALYSIS.

Combustion—Combustion is a chemical action accompanied by light and heat.

Decompose—To break up into simpler parts.

Decomposition—The act or process of breaking a compound into its constituent parts or elements.

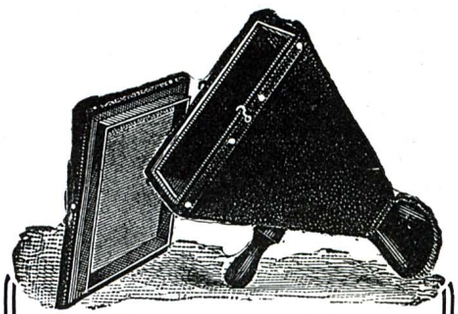
Equation—A Chemical Equation represents symbolically a chemical reaction, the symbols of the new substances formed by the reaction being placed on the right hand, while the symbols of the reacting substances are placed on the left hand. In a chemical equation the number of atoms of each element must be the same on each side of the equation.

An *Oxide* is a compound of oxygen with another element.

Oxidation is the combination of oxygen with a substance.

Slow Oxidation is the combination of oxygen with a substance without noticeable light and heat. The rusting of iron represents Slow Oxidation.

(*Continued on page 528*)



X-RAY FLUOROSCOPES

5x7 size with Astrale screen complete as shown **$8.50**

"ASTRALE" X-RAY SCREENS

Have the fluorescent salts deposited directly on heavy celluloid making the screen dust and water proof as well as mechanically strong.

Do not use old style paper screens easily punctured and which deteriorate in time.

Sample order will convince you.

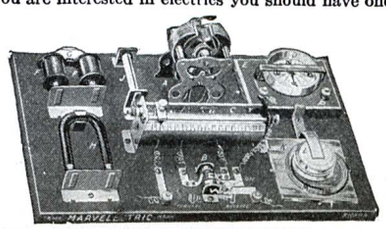
Standard Sizes Complete Screens in Frame
2x3 $1.50 5x7 $5.00 8x10 $10.00

ROSENTHAL LABORATORIES, CAMDEN, N. J.

DEPENDABLE **KNAPP** ELECTRIC SPECIALTIES

"MARVELECTRIC" EXPERIMENTAL LABORATORY

A complete outfit for performing innumerable experiments. Demonstrates Magnetism, Solenoids, Resistance, Motors, Dynamos, etc. Strong, durable, well-made, fascinating and instructive. If you are interested in electrics you should have one. **$3.75**



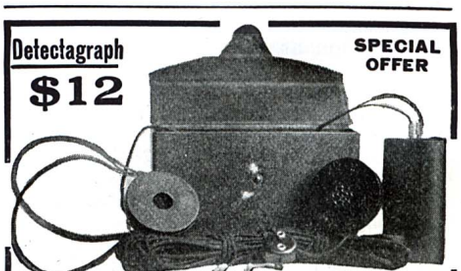
AT ALL LIVE DEALERS

Insist on your dealer showing you the KNAPP line—KNAPP goods are best. If your dealer cannot supply you, order direct. Send for FREE illustrated catalogue showing a complete line of Electrical Motors and Novelties ranging in price from 10c to $10.

KNAPP ELECTRIC & NOVELTY CO.
523 West 51st Street, N. Y. City

Detectagraph **SPECIAL OFFER**

$12



Our famous Micropho-Detectagraph is now offered at an extremely low price. This detecting instrument of marvelous sensitivity can be used for detecting secret conversations.
Outfit consists of Sensitive Transmitter and connector, 25-ft. Black Cord, Receiver, Headband, Case and Battery. The Transmitter weighs only two ounces. Price complete $12.00 for a limited number only.

MICROPHO-DETECTOR COMPANY
Gaston Boissonnault, Pres. 119-121 Nassau St., N. Y. C.
Makers of Detecting Apparatus from $12.00 to $250.00

Electricians

Get up-to-date in HOUSE WIRING! Save TIME, MONEY, LABOR and MATERIAL by using our 86 GENUINE BLUE PRINT DRAWINGS, containing all the latest diagrams and connections known in house wiring---every diagram and connection up-to-the-minute as used by first class electricians for wiring BELLS, BURGLAR ALARMS, LIGHTS, ANNUNCIATORS, FIRE ALARMS and ELECTRIC GAS LIGHTING. These drawings are bound in the form of a flexible book (9 x 12) for convenience in using on the job. Send for them, and if they don't make you more efficient as a wireman and save you a hundred times their cost as a contractor, return them and money will be refunded---you can't afford to be without them. ONE DOLLAR post paid.

PATENT SPECIALTY COMPANY

462 Sanchez Street San Francisco, Cal.

ENTERTAIN YOUR FRIENDS

Send 10 cents for Two Standard Puzzles, and receive FREE Two Card Tricks, Two Coin Tricks, Two Joke Novelties, complete with apparatus and catalogues.

CHICAGO PUZZLE WORKS
3310 Herndon St. Room 117 Chicago, Ill.

Wireless Apparatus MESCO of Known Quality

MESCO Short Wave Regenerative Receiver

Recommended for relay work on wave lengths of 180 to 450 meters. It is possible to receive wave lengths up to 1,000 meters with reduced amplification.

The circuit is the Armstrong regenerative with constants accurately calculated for the wave lengths when employed in conjunction with audion detectors.

Will receive undamped and damped waves.

No. 8467—MESCO Short Wave Regenerative Receiver.....Price **$32.50**

Will increase receiving range of any station over 100 times.

Complete in every detail and ready for operation when connected to an aerial ground audion detector and telephone receivers.

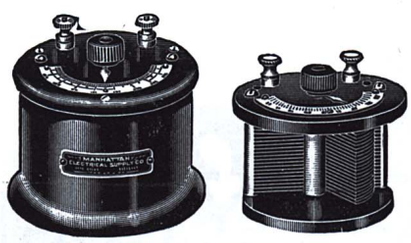
A blue print of connections with detailed instructions for setting up and operating this receiver is supplied with each instrument. Oak cabinet.

The metal parts are of brass, nickel polished.

Intensifying Transformer

Can be used with any crystal detector in connection with Audion. Signals can be intensified 10 to 25 times.

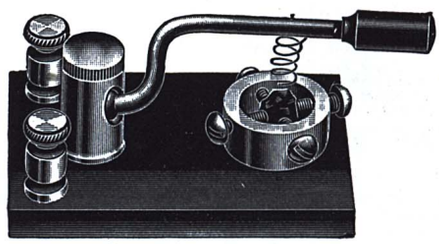
No. 224.....Price **$12.00**



Variable Condenser

Capacity .001 M. F. a thoroughly reliable and scientifically made instrument.

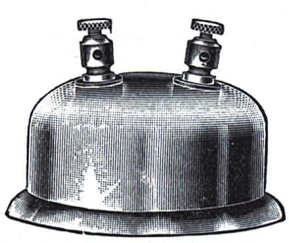
No. 294.....Price **$4.00**



Universal Detector Stand

Remains permanently in adjustment. One of the most simple and effective Detector Stands made.

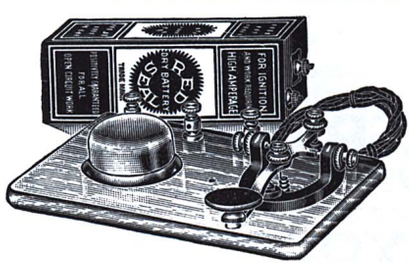
No. 248.....Price **$3.00**



Fixed Receiving Condenser

For stationary and portable outfits. Diam. 2⅛ in. Base removable and can be screwed to table. Large capacity.

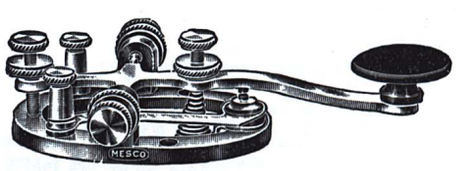
No. 440.....Price **$0.83**



Wireless Practice Set

The most perfect set made. Equivalent to five different sets. Supplied complete with Red Seal Dry Battery.

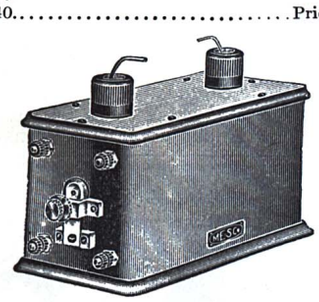
No. 342.....Price **$2.07**



Wireless Key

The last word in efficient wireless key construction.

No. 452—N. P. Lever.....Price **$1.98**



Wireless Spark Coil

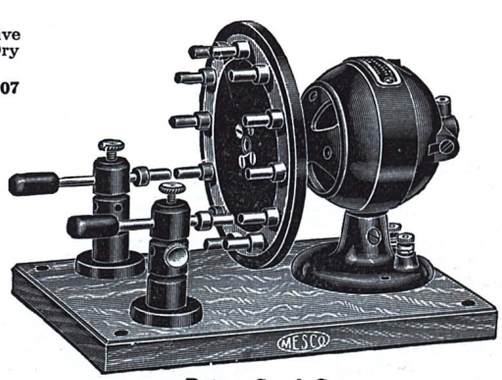
Unquestionably the best on the market today. Best coil to use on Dry Batteries as the consumption of current is very low. Made in ¼-in. to 4-in. The 3-in. and 4-in. supplied with separate primary condenser.

No. 495—3-in.....Price **$21.00**
No. 496—4-in.....Price **$34.80**

Telephone Receivers

Very high grade. Can be used on 2000 miles. Extremely sensitive. 1000 ohms.

No. 480.....Price **$6.00**



Rotary Spark Gap

Will increase the efficiency of any Transmitting Station 20 to 30 per cent. Has very high clear note. Can be used on spark coils or transformers up to 1 k.w. capacity.

No. 222—6v.....Price **$12.00**
No. 223—110v.....Price **$13.00**

Send 10c. for New Wireless Manual A 9

The most complete book of its kind published. You cannot possibly afford not to have one. Contains 180 pages. Send for one NOW.

YOU WILL GET YOUR 10 CENTS BACK ON AN ORDER FOR $1.00

Our Pocket Electrical Catalogue W28, 248 pages, mailed on request. This catalogue contains practically everything in general use in the electrical line and is in fact a small pocket encyclopedia of electrical goods information.

17 Park Place - - - New York
114 S. 5th Avenue - - Chicago

MANHATTAN ELECTRICAL SUPPLY CO.

1106 Pine Street - - St. Louis
604 Mission St., San Francisco

Wireless Taught By Mail

You May Learn Theory, Code and Laws of Radio Communication in Our School or at Your Home

fitting you for positions paying good salaries with wonderful chance to travel the world over. It's the most interesting profession known and the demand for skilled operators is increasing.

Send stamp for catalog giving facts. Resident classes open Oc.. 2nd.

NATIONAL RADIO SCHOOL, 14th & U Sts., N. W., Washington, D.C.

WASHINGTON Offers Special Advantages for These Courses.

We Are Prepared to Teach You Wireless

Under Marconi Co.'s Chief Instructor

EQUIPMENT. Consists of long distance wireless equipment of the very best commercial style provided by one of the large commercial companies with a 2 K. W. transmitter and receiving apparatus, having a Trans-Oceanic range of 5,000 miles.

PERSONNEL. The entire course is under the direction of Mr. E. E. Bucher, instructing engineer of Marconi Wireless Telegraph Company of America. His assistants stand equally high in the wireless field.

THE DEMAND FOR RADIO OPERATORS FAR EXCEEDS THE SUPPLY

Our licensed employment department assists out-of-town students to locate temporary employment while comfortable accommodations are available in the new Association Building, location of which is ideal for students from Jersey, Lower New York, Long Island City and Brooklyn. Our folder E will prove of great interest and will give you much information regarding our school.

EASTERN DISTRICT Y. M. C. A., MARCY AVE. NEAR BROADWAY BROOKLYN, N. Y.

13 minutes from New York City Hall — 18 Minutes from Hudson Terminals

LEARN WIRELESS

At the largest, best equipped and ONLY practical Radio school in New England. ENDORSED BY GOVERNMENT AND MARCONI OFFICIALS. Last year we placed *EVERY ONE* of our graduates in good positions; operating in all parts of the world, and still are unable to fill the demand for them. Day and Evening classes now in session. Send stamp for *new* Fall prospectus which contains detailed information.

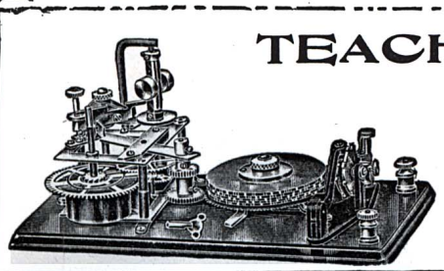
899 B BOYLSTON STREET **EASTERN RADIO INSTITUTE** BOSTON, MASS.

"THERE'S MONEY IN IT"

AT HOME LEARN TELEGRAPHY AT HOME

MORSE AND WIRELESS

TEACH YOURSELF



in half the usual time, at trifling cost, with the wonderful Automatic Transmitter, **THE OMNIGRAPH.** Sends unlimited Morse or Continental messages, at any speed, just as an expert operator would.

Adopted by U. S. Gov't. 4 styles. Catalogue free.

OMNIGRAPH MFG. CO.

39L Cortlandt St. New York

THE NEW YORK ELECTRICAL SCHOOL

THE N. Y. ELECTRICAL SCHOOL is the pioneer and premier school of the "Learn by Doing" method. When you have completed this Course you shall be fully qualified to handle ALL branches of Electrical industry.

The equipment of this School is unequalled and up-to-the-minute. No preparation needed to become a "learner" in this school. You can start to learn on any day of any week throughout the whole year. Send for catalogue.

New York Electrical School

29 West 17th Street New York City

EXPERIMENTAL CHEMISTRY.

(*Continued from page 526*)

Reaction—A reaction is the chemical change or effect produced by bringing at least two elements or compounds together, whereby one or more new bodies are formed, which may consist either of a gas, liquid, solid, or a mixture of these.

ACTIVITIES OF THE NEW BRITAIN RADIO CLUB.

(*Continued from page 489*)

and at sea. Many evenings when Arlington or some other powerful station is sending, he can lay the receivers on the table, go to bed and still hear them sending. Then when he has had enough he can shunt the phones by means of a small switch on the bed.

Mr. Bollerer obtains very good results with his set and hears many amateurs within a radius of 500 miles. He hears a ¼ K.W. set 250 miles away very plainly and a ¾ K.W. set 800 miles away from his station. Within 300 miles his signals can be heard very strongly. Many times he hears Colon, Panama, and Key West, Fla., working. He holds a radio license from the U.S. Government—call 1VH. He is desirous of exchanging photographs of his set with other amateurs.

Mr. Mulvihill's set consists of the following: The receiving set comprises 1,800 meter loose coupler, Holtzer-Cabot receivers and two variable condensers set into the table. There are three detectors used, galena, Crystaloi and an Audion. A wave meter is employed to indicate the wave length of the incoming messages. Two D.T.S.P. switches are used to switch on the desired detector.

The receiving aerial measures 183 feet long and 137 feet high, composed of 2 strands of phosphor bronze wire, spaced 10 feet apart. The sending aerial is 80 feet long and 137 feet high.

The sending instruments include a 1 K.W. transformer, a stationary gap and a rotary gap having a speed of 9,000 R.P.M.; the disk is 6 inches in diameter with 12 plugs. There are also an oscillation transformer, a kick back preventer, a .001 mfd. condenser and two keys.

All the operating switches are mounted on the switchboard in front of the set, which makes it very easy for the operator to handle it. Mr. Mulvihill has been experimenting with a wireless telephone and has succeeded in working it up to a distance of 5 miles. Signals can be heard from NAA, NAR and NAX, with the 'phones 15 feet away. Under good conditions a dis-

tance of 435 miles can be covered with the sending transformer. His call is 1TB.

The radio station owned by Mr. Wesley Parker operates with an aerial 70 feet long, 40 feet high, composed of four strands of No. 14 copper wire, spaced 2 feet apart. The lead-in is of No. 4 copper wire, run to a 600 volt, 100 ampere, lightning switch. From it there runs a No. 4 copper wire to the ground proper.

The receiving set is composed of a loose coupler (single slide) with loading coil, fixed condenser and galena detector, both made by the Wm. J. Duck Co. Further there is a pair of E. I. Co. 2,000 ohm 'phones. A buzzer test circuit operated by a foot type switch on the floor is provided.

The sending apparatus includes a 1-inch Mesco spark coil, J. H. Bunnell key, Murdock spark-gap, and a home-made glass plate condenser, also a helix. Arlington is heard very loud without using the loading coil.

The radio station of Mr. Robert Yuon is described below:

A phosphor bronze four-wire aerial about fifty feet in length with a long lead-in is used. The ground is obtained through a connection to a water pipe.

The receiving set comprises the following: one long wave loose coupler and a loading coil, by means of which he can tune up to 4,000 meters. There are two detectors, one crystal which is used on local stations, and one Audion which is used on the long distance work. For close tuning there is available a variable condenser; also a fixed condenser is shunted across the 'phones.

The transmitting set is made up of the following: ½ K.W. transformer-coil which may be operated with an electrolytic interrupter or by vibrator on direct current, the latter being obtained by a rectifier, which changes A.C. to D.C. A rotary spark gap and a fixed gap are available but he finds that the rotary is the better of the two. A glass plate condenser with twenty plates of glass and nineteen plates of very thin tin-foil is used. He obtains a very sharp wave and with conditions favorable can easily transmit 35 miles. Mr. Yuon holds an operator's license and his call is 1DG.

A recent Club radio display included a replica of Marconi's first set, which sent the first message across the Atlantic; old and modern receivers; transformers, coils, detectors, sending keys and many other parts of apparatus constituting a complete wireless set.

The Radio Club of New Britain was founded two years ago and has been successful ever since. To any person interested in the club's work the club extends an invitation to attend its meetings which are held every Tuesday night. The fee for membership is $0.25 a month and the initiation fee $1.00.

For particulars about the club's work and the requirements for membership address the Secretary, Radio Club of New Britain, 77 Linwood Street, New Britain, Conn.

DO YOU

own a wireless station, either for sending or receiving? If you do, don't fail to join the greatest Wireless Association in the country: THE RADIO LEAGUE OF AMERICA. If you believe in the preparedness of your country, if you wish to help Uncle Sam, if you wish to have your station **officially** recognized, join the LEAGUE, a national, non-money-making organization. Beautiful engraved and sealed certificate, FREE to all members. NO DUES OR FEES WHATSOEVER.

Honorary Members: W. H. G. BULLARD, U. S. N.; PROF. REGINALD A. FESSENDEN; DR. LEE DE FOREST; DR. NICOLA TESLA.

Send stamp for large 8-page information booklet.
DO IT NOW. Address 233 Fulton St., N. Y. City

$2.50 a Month

The masterpiece of watch manufacture—adjusted to the second, positions, temperature and isochronism. Encased at factory into your choice of the exquisite new watch cases.

21 Jewel Burlington

All sizes for both men and women

The great Burlington Watch sent on simple request. Pay at rate of $2.50 a month. You get the watch at the same price even the wholesale jeweler must pay.

Write Today for Free Watch Book

See handsome color illustrations of all the newest designs in watches that you have to choose from. Your name and address on a postcard is enough. Get this offer while it lasts. Write today.

Burlington Watch Co. Dept. 7448 19th & Marshall Blvd. Chicago

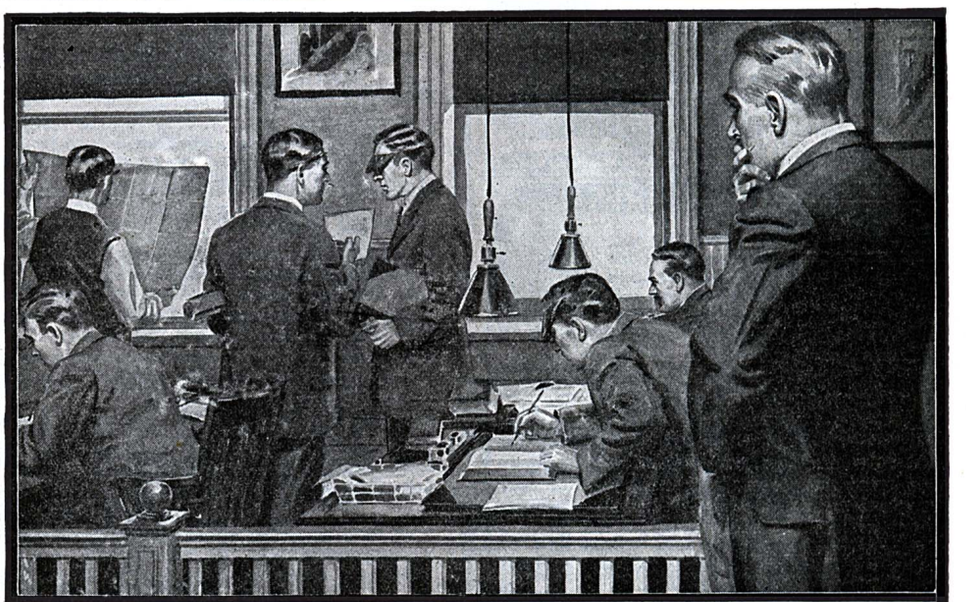
STUDY PRACTICAL ELECTRICITY Through This Extension Course

Splendid opportunity to master electricity at home through an extension course of the School of Engineering of Milwaukee, the most thorough electrical school in America, with a record of 12 years of success in teaching practical electricity. Hundreds of successful students. Not a theoretical correspondence course, but identically same lessons—same instructors—same attention—as at school. You cannot acquire the same proficiency in any other way at home.

ONE YEAR'S TRAINING Without Cost

This masterful instruction puts you on the high road to success in the electrical profession—a wonderfully good paying field—woefully short of trained men. Write for free folder "Master Electricity at Home." It explains how you can secure a year's course without cost and points out the many opportunities for earning big money in the electrical field. Don't put it off. Write now.

SCHOOL OF PRACTICAL ELECTRICITY
605 Stroh Bldg. Milwaukee, Wis.



The Boss is Sizing You Up

Whether you know it or not, he's on the lookout all the time for men he can *promote*. He's ready and anxious to give you bigger work and bigger pay once you prove you can handle it. But your chance for promotion depends entirely on yourself.

If you're *satisfied* just to hang on where you are, rest assured that's as far as you'll ever get. But if you *want* to get ahead, if you want to *be* somebody, to climb into a position of responsibility and good money—

Get Ready—Your Chance Will Surely Come

Choose the position you want in the work you like best—then train for it. You can do it in spare time in your own home without losing a day or a dollar from your present occupation—through the International Correspondence Schools. More than 100,000 men *right now* are putting themselves in line for promotion through the study of I. C. S. Courses. Last year nearly 5,000 men reported advancement and increased earnings as the result of their I. C. S. training.

What the I. C. S. have done for others they can surely do for you.

No matter where you live, if you can be reached by the mails, the I. C. S. will come to you. No matter how humble or important your present position, I. C. S. training will help you go higher. No matter what your chosen work may be, some one of the 280 practical I. C. S. home-study courses will just suit your needs.

Choose Your Career

Do you like Advertising? Many of the foremost advertising managers in this country were I. C. S. trained. Salesmanship? Thousands of I. C. S. trained men are winning success in the selling game. Accounting? Commercial Law? All over America accountants, bookkeepers, office managers, private secretaries, are reaping the rewards of training gained in I. C. S. spare-time study of these subjects. Engineering? Architecture? Electricity? Hundreds of thousands of men have climbed into big jobs in the technical professions through I. C. S. help.

The boss is sizing you up. If you want a big job that carries responsibility and good money, *get ready for it*. There is an I. C. S. way to do it and all the I. C. S. ask is the chance to show you what it is. The way to find out is to mark and mail this coupon. Do it *now*. It will be the first step upward.

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 5323, Scranton, Pa.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 5323, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

- ☐ ADVERTISING MAN
- ☐ Salesmanship
- ☐ Commercial Law
- ☐ BUSINESS (Complete)
- ☐ Certified Public Accountant
- ☐ Higher Accounting
- ☐ Bookkeeper
- ☐ Stenographer and Typist
- ☐ Railway Accountant
- ☐ WINDOW TRIMMER
- ☐ Show Card Writer
- ☐ Outdoor Sign Painter
- ☐ Common School Subjects
- ☐ Good English
- ☐ Teacher
- ☐ Civil Service
- ☐ Railway Mail Clerk
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ MECHANICAL ENGINEER
- ☐ Mechanical Draftsman
- ☐ Machine Shop Practice
- ☐ Stationary Engineer
- ☐ Gas Engineer
- ☐ ELECTRICAL ENGINEER
- ☐ Electric Lighting
- ☐ Electric Car Running
- ☐ Electric Wiring
- ☐ Telegraph Expert
- ☐ Practical Telephony
- ☐ Railroader
- ☐ Mine Foreman or Engineer
- ☐ Metallurgist or Prospector
- ☐ ARCHITECT
- ☐ Contractor and Builder
- ☐ Architectural Draftsman
- ☐ Concrete Builder
- ☐ Structural Engineer
- ☐ Plumbing and Heating
- ☐ Sheet Metal Worker
- ☐ CHEMICAL ENGINEER
- ☐ Illustrator
- ☐ Designer
- ☐ Textile Overseer or Supt.
- ☐ AGRICULTURE
- ☐ Navigator
- ☐ Poultry Raising
- ☐ AUTOMOBILES
- ☐ Spanish
- ☐ German
- ☐ French
- ☐ Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____

If name of Course you want is not in this list, write it below.

COME TO DETROIT, THE AUTOMOBILE CENTER AND LEARN THE AUTOMOBILE BUSINESS

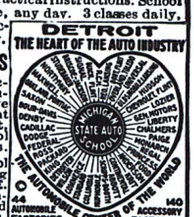
Detroit trained men get preference and get jobs quickly. No other city or school offers such possibilities. Factories endorse our school, glad to get graduates, offer territory in which to sell cars and start garages.

Earn $75 to $300 a Month

Our equipment is complete. Students build cars from start to finish. Complete course in Oxy-Acetylene Brazing, Welding and Cutting, separate from regular course. All leading types of starting, lighting and ignition systems in operation. 6 cyl. Lozier, 8 cyl. King used for road instruction.

DETROIT IS PLACE TO LEARN

44 Auto Factories in Detroit. You get practical instructions. School open all year. Enter classes any time, any day. 3 classes daily, morning, afternoon and evening. Factories ask for trained men constantly.



START GARAGE — SELL CARS

We have arrangements with the Factories to put them in touch with graduates who intend entering business. Have arrangements with Eastern Investment firm (worth millions) to back competent, reliable, Michigan State Auto School graduates in garage and selling business.

ACT QUICKLY Get "Auto School News," Catalog with money back guarantee, all FREE. Or better still, jump on a train, as hundreds have done, and come to "the Old Reliable School." We have no branches.

MICHIGAN STATE AUTO SCHOOL
A. G. ZELLER, President
671 Auto Bldg., 11-19 Selden Ave., Detroit, Mich.

Learn to PAINT SIGNS and SHOW CARDS

Get into this interesting, profitable and fascinating business where the field is not crowded. Thousands of cards used weekly. Department stores, clothiers, movie shows, etc., pay big prices—work done quickly and easily—profits large—hundreds of jobs all around you. My students can more than pay for course doing jobs in spare time while studying. Increase your salary, get a better job or go into business for yourself.

Earn $18.00 to $45.00 a Week—Easily

I will train you to fill a high salaried job. I personally correct every lesson. 17 years' successful teaching. Thousands of successful graduates all over the world. No town too small, no job too big for my graduates. Get my training—start now.

Big Money in Card, Sign and Bulletin Business

No other profession pays such profits--work comes to you in abundance--no job will stump you. My students learn all. All the newest, swellest designs, how to run the business, how to hire men, how to keep records, in fact gives you a complete training. You can finish my course in a short time. Read my guarantee -- don't be out of a job or work at low wages any longer--

FREE Outfit
Write now for special literature and prices on 5 courses--terms, testimonials, sample lesson and Free Outfit offer. ALL FREE--Don't delay, act quickly.

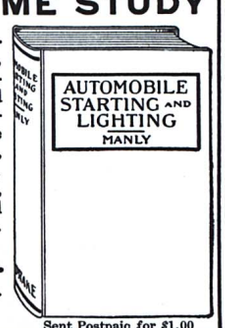
Guarantee
I guarantee to place competent graduates at $85.00 to $175.00 monthly. The demand for trained competent men is far greater than the supply.

Get Started Now

Detroit School of Lettering, DEPT. 3711 **Detroit, Mich.**

FREE Send for large Catalogue of
Practical Mechanical Books
FOR HOME STUDY

Best Books for Electricians, Telephone Men, Motion Picture Operators, Engineers, Railroad Men, Motormen, Draftsmen, Automobile Mechanicians, Plumbers, Carpenters, Builders, Sign and Card Writers, also Bookkeepers and Civil Service Applicants.



F. J. DRAKE & CO.
Dept. 6. 1006 Michigan Ave.
CHICAGO

Sent Postpaid for $1.00

FREE This Complete Set of Drawing Instruments

$15.00 Draftsman's Complete Working outfit, absolutely free. They do not cost you a penny on this offer. Write for particulars.

$150.00 to $300.00 a Month My graduates are earning from $150 to $300 a month and more. **Write Today,** Send for my free book on drafting. No obligations. Write now.
Chief Draftsman Dept. Div 3388
Engineers Equipm't Co., Chicago

Learn Watchwork, Jewelrywork and Engraving. A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL Department, Bradley Institute, Peoria, Ill., for our latest catalog.

STANDARD RADIO TERMS DEFINED.

Approved by the Institute of Radio Engineers.

Under this head we will define the most important radio terms each month. Save them and by pasting each in a book (properly indexed) you will have a handy radio dictionary.

104. *Signaling, Duplex:* See Duplex Signaling.
105. *Sharpness of Tuning:* The measure of the rate of diminution of current in transmitters and receivers with detuning of the circuit which is varied.
If d_2 is the decrement of the free alternating current in the circuit and d_1 the decrement of the exciting E. M. F., then the sharpness of tuning is arbitrarily defined as
$$\frac{2\pi}{d_1 + d_2}$$
106. *Spark:* An arc of short duration.
107. *Static:* Disturbances caused by atmospheric charging of the antenna.
Note: When it is definitely known that disturbances are due to atmospheric charging of the antenna, the word "Static" shall be used. In general, disturbances shall be called "Strays."
108. *Strays:* Electro-magnetic disturbances set up by distant discharges.
109. *Telegraphy, Radio:* The art of sending and receiving radiograms.
110. *Telephony, Radio:* The art of sending and receiving radiophones.
111. *Train, Wave:* The waves emitted which correspond to a group of oscillations in the transmitter. See also, Frequency, Group.
112. *Transformer:* In present radio practice the term should be restricted to audio frequency transformers. See Frequency, Audio.
113. *Transmission, Diplex:* See Diplex Transmission.
114. *Tuning:* The process of securing the maximum indication by adjusting the time period of a driven element. See Resonance.
115. *Tuning; Sharpness of:* See Sharpness of Tuning.
116. *Vacuum Tube, Three Electrode:* As examples see Relays, Electron and Gas.
117. *Vacuum Tube, Two Electrode:* As examples see Rectifiers, Electron and Gas.
118. *Waves, Electro-magnetic:* A periodic electromagnetic disturbance progressive thru space.
119. *Wave Length (of an Electro-magnetic Wave):* The distance in meters between two consecutive maxima, of the same sign, of the electric and magnetic forces.
120. *Wave Length, Fundamental:* See Fundamental Wave Length.
121. *Wave Length, Natural:* In a loaded antenna (that is, with series inductance or capacity) the natural wave length corresponds to the lowest free oscillation.
122. *Wave Changer:* See Changer, Wave.
123. *Wave Meter:* A radio frequency measuring instrument calibrated to read wave lengths.
124. *Waves, Sustained:* Waves radiated from a conductor in which an alternating current flows.
125. *Wave Train:* See Train, Wave.

TESTS AND RATING

1001. *Radio frequency generators should be rated* according to their capacity at continuous load. The method of measuring output in operation is given in Sections 1011 and 1012 below. Unless otherwise specified, a continuous load shall correspond to a locked key test.
1002. *Radio transmitting sets should be rated* on the basis of their actual antenna input, not including in antenna input the losses in the antenna switch, and in antenna loading inductances or series capacities. The radio transmitting set starts therefore at the first piece of electrical equipment definitely a part thereof, comprises all further equipment, and includes the antenna switch and antenna loading inductances and series capacities (or any other apparatus placed in the antenna circuit which forms part of the transmitting equipment; e. g., an antenna relay for break system).
1003. The *over-all efficiency* of a radio transmitting set shall be the quotient of the actual power output measured in a standard antenna (either real or artificial) to the power input supplied to the first piece of electrical equipment which is definitely a part of the radio transmitter. Examples of the application of this rule are the following:
1004. (a) *A ship station.* Direct current is supplied from the ship's mains to a motor generator set, which furnishes alternating current to the high tension transformer of the radio set. The ratio of power in the antenna to power supplied to the motor of the motor generator set and to the auxiliary radio equipment (e.g., blower motors, rotary gap motors) is the over-all efficiency.

POCKET DIARY AND YEAR BOOK FOR 1916. Edited by the *Mechanical World.* 429 pages, 85 illustrations, cloth bound, 6 by 4 inches. Price 25 cents. Published by Emmott and Co., Ltd., Manchester, England.

A large fund of valuable information has been crowded into the pages of this pocketbook. There are one hundred and fifty pages of data on steam, oil and gas engines. Such details as indicators, construction of boilers, steam calculations, valve laps and condensing plants are taken up.

Separate chapters are devoted to structural iron work, gear cutting, ball bearings, rope drives and the shrinkage of castings. Thirty pages are devoted to tables commonly used by machinists and designers. There is also a diary for keeping mechanical notes. A commendable volume, indeed, at such a low price, and one that will certainly prove useful to anyone interested in such matters.

ELECTRIC POCKET BOOK FOR 1916, edited by the *Mechanical World,* 240 pages, 130 illustrations, cloth covers, 6 by 4 inches. Price 25 cents. Published by Emmott and Co., Ltd., Manchester, England.

It is impossible for such a small book to contain a complete compendium of electrical information, but this was not the intention of the publishers. The table and the data seem to have been carefully selected to give the most important data on the large number of subjects which it covers.

The first pages are devoted to definitions of electrical units, followed by a discussion on the care and installation of A.C. and D.C. motors and generators with calculations used in their circuits. Lighting and power circuits are rather briefly covered, as well as the controlling apparatus necessary. Data is also given on storage and primary cells, electric lighting, measuring instruments, earth connections, bell circuits, use of electricity in mines, welding and elevators. The final pages are taken up by mathematical tables and a diary for the use of those who wish to keep brief data notes.

The advertising matter on the first and last pages (an abominable European custom in bookmaking) does not improve the book, but this seems to be characteristic of English publications.

THE ENGINEER IN WAR. By P. S. Bond. Flexible imitation leather, 187 pages (4¾x7¼ inches), illustrated. McGraw-Hill Book Company, New York, N. Y. Price, $1.50.

This book was written by an army officer and the material is reprinted, with revisions and additions, from *The Engineering Record.* The aim of the book has reference to the training of the citizen engineer to meet the military obligations of citizenship. The duties of the military engineer are explained at some length, while separate chapters are devoted to such topics as stream crossings, roads, fortifications, demolitions, map sketching and sanitation. The work of the signal corps, which brings in essentially electrical applications, is not mentioned, but the subjects treated on cover all the more important duties of the military engineer as outlined above. A number of excellent illustrations help to make the text more comprehensive to the lay reader. It is a book worthy of attention by all at this time and especially those skilled in electrical and mechancial matters.

ELECTRIC WIRING DIAGRAMS AND SWITCHBOARDS. By Newton Harrison, with additions by Thomas Poppe. Second edition, revised and enlarged. Flexible imitation leather, 303 pages (4½x6¾ inches), 130 illustrations. The Norman W. Henley Pub. Co., New York, N. Y. Price, $1.50.

This volume is intended especially for those interested in the designing and constructing of switchboards. Tables are given for the carrying capacity of copper wires of various sizes, current required by carbon lamps (but not for Tungsten lamps, strange to say), etc. The underlying principles of the why and the wherefore of each computation is explained briefly—too briefly it seems for many who will read this book. However, for those engaged in figuring out such problems in their everyday work, this book will prove of service. Considerable space is devoted to alternating current calculations, transformer connections for phase changing, circuits of various types of wattmeters, etc. It would seem preferable to have presented the A.C. line values for inductance and capacitance in tabular form instead of in rather brief formulae.

PATENT ADVICE

Edited by H. GERNSBACK

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

PUSH BUTTON.

(100) Wells Asbury, Clarkesville, Georgia, has submitted a very unique idea for making an electrical push button for ringing bells, etc., which generates its own current. Our advice is asked whether or not this could be patented, and if it would pay to patent it.

(A) This idea is an excellent one, providing the button could be manufactured cheap enough. There should be an immense market for it, providing the button could be sold for $2.00 apiece or less.

Our advice is to get in touch with a patent attorney at once.

ELECTRIC BICYCLE.

(101). Karl Lopsein, Germantown, Cal., has been figuring on making an electric bicycle and would like to have our advice as to its practicability and whether it will work as described. The idea of the construction is to put a generator in a convenient place on a frame and run it by foot power which in turn supplies the current for the motor, this finally to propel the bicycle.

(A) While a device of this kind would undoubtedly work, there certainly is no advantage whatsoever, as quite a good deal of the foot power is lost in the transmission of one form of power to another. We do not think the device practical at all.

AUTOMATIC TRAIN STOP.

(102.) Ina K. Robinson, South Haven, Kans., proposes to place a horizontal lever on each side of the locomotive which would extend a few inches, the inner end of each being connected to switches, such switches to control a circuit so that when the switch was closed the throttle would be closed and the brakes applied. Several other points are mentioned in connection with this idea.

(A) Devices of this sort are not very popular with the railroads, as they do not seem to favor extending levers, although a few railroads have adopted similar schemes. Unless an entirely new device were devised in such a scheme, we doubt if a patent could be obtained.

BICYCLE CARRIER.

(103.) Norman E. Himes, Norwich, Conn., has an idea for a carrier for a bicycle which he thinks could be sold for 25c at a good profit. It is to be made of light sheet iron enameled and fastened under the seat. It is to be specially used to carry books, parcels, etc.

(A) While the device as described seems very satisfactory and while we think that a patent might be obtained on a device of this kind, we do not think that there is a very great market for such an article. There are a good many such devices on the market already.

CHEMICAL APPARATUS.

(104.) Dole A. Miller, Toledo, Ohio, has devised an apparatus designed to separate hydrogen and oxygen, consisting of several brass chambers. Other details are also given and the apparatus is supposed to be used by high schools, universities, etc.

(A) Without seeing sketches or more detailed description of the apparatus it is impossible to say whether a patent could be obtained or not. There are so many such devices on the market to-day that we doubt whether one could be designed original enough on which a patent could be obtained.

ELECTRIC AUTOMOBILE PLANT.

(105.) Claude Spitzer, Grottoes, Va., has sent us a very elaborate drawing and description as well, of an electrical transmission for automobiles. The device consists of a dynamo generator driven by a gas engine, the generator in turn supplying current to two electric motors which drive the car. Our correspondent, who is certain that a patent can be obtained on this device, wants our advice as to the practicability of it and whether an article of this kind would be satisfactory from a manufacturing viewpoint.

(A) Electric transmissions on automobiles are not new but the one of our correspondent shows several distinct improvements, especially as far as the arrangement of the motors is concerned, which drive the wheels. Several novel points are contained in the invention and while we do not think that a patent could be obtained on the invention as a whole, one or more patents might be obtained on several of the different ideas. "Electric" automobiles seem to be coming into favor more and more, and there is a distinct advantage to have a gasoline engine drive a generator which in turn drives the automobile. This is not at once apparent to the layman on account of the loss of the power. In automobiles, however, a small loss of power is not considered much if the smooth working of the car is taken into account and if the far better control of electric driving is considered.

We would advise our correspondent to get in touch with a patent attorney.

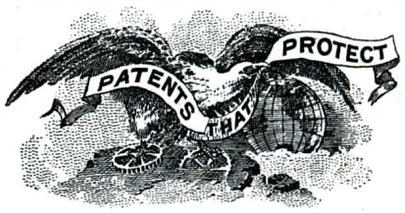
NATURAL GAS FOR AUTOMOBILES.

(106.) St. Elmo Brumback, Missouri, informs us that he has been using natural gas

R. S. & A. B. LACEY Established 1869

Members Bar United States Supreme Court and Supreme Court District of Columbia.

PATENT PRACTICE EXCLUSIVELY



No matter how much money you OUGHT to get for your invention, it is not likely to bring you a penny unless you know what you are about in selecting attorneys. WELL-KNOWN patents worth millions of dollars, secured through us, made our reputation as

"The Attorneys Who Obtain Patents that Protect"

Abundant evidence, such as you can readily verify, will be submitted to show the *unsurpassed success* of our clients, and that

The Patents We Obtain Are Not the Kind Merely *Said* to be "Wanted," but the Kind that Manufacturers BUY

No lower charges than ours are quoted by any other trustworthy attorneys; and we do not, by deceptive free offers, money-back schemes, or in any other way, use our terms as a bid or bait for patronage. Mere representations, boasts, and promises, characterize much fine patent literature and advertising, but we challenge a comparison of RESULTS.

Reliable book containing information not obtainable in any other publication and worth a possible fortune to YOU if you have inventions to be patented, will be mailed *free* on request. Write.

R. S. & A. B. LACEY, 99 Barrister Bldg., Washington, D.C.

PATENTS

IF YOU HAVE AN INVENTION which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention, and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of seventy years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand-Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to **Patents, Trade Marks, Foreign Patents,** etc.

All patents secured through us are described without cost to the patentee in the *Scientific American.*

MUNN & CO.

SOLICITORS OF PATENTS

699 WOOLWORTH BLDG., NEW YORK and 625 F STREET, WASHINGTON, D. C.

PATENTS WANTED **Write** for List of Patent Buyers who desire to purchase patents and What To Invent with valuable list of Inventions Wanted. $1,000,000 *in prizes* offered for inventions. Send model or sketch for Free Opinion as to patentability. We have a Special Department devoted to Electrical Inventions and are in a position to assist and advise inventors in this field in the development of their inventions.

MODERATE FEES--WE ASSIST INVENTORS TO SELL THEIR PATENTS

Write To-Day for our Five Books sent free to any address. (See attached coupon:)

FREE COUPON!

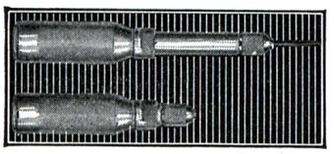
VICTOR J. EVANS & CO., Patent Attorneys

NEW YORK OFFICES: 189-191 Broadway **PHILADELPHIA OFFICES: 1429 Chestnut St.**

Main Offices: 779 9th Street, N. W., WASHINGTON, D. C.

GENTLEMEN: Please send me FREE OF CHARGE your FIVE Books as per offer.

NAME ..... ADDRESS .....



Small Holes Quick!

You can drill small holes "as quick as a wink" with

MILLERS FALLS
AUTOMATIC POCKET BORER No.8

One of the handiest little tools that you can have. Length compressed to fit your pocket, 4⅞ inches—extended 7¼ inches. Magazine handle contains 8 drill points 1-16 to 11-16 inches and a screw driver bit. By a special device, each bit can be released without disturbing the others. Chuck grips fast until released.

See this handy tool at your dealers—you'll take one away in your pocket.

Mechanics' Handbook full of valuable Mechanical information, never before printed, and pocket catalog—free on request.

MILLERS FALLS CO.
"Toolmaker to the Master Mechanic"
MILLERS FALLS, MASS.
N. Y. Office: 28 Warren St.

REGISTERED PATENT ATTORNEYS
PATENTS AND TRADE MARKS
LANCASTER & ALLWINE
D.C.
252 Ouray Bldg. Washington, D. C.
Book "Inventions—Patenting and Promoting" Free
Improvements wanted—Send for free bulletins & advice

WANTED-IDEAS
Manufacturers are writing for patents procured through me. FREE: 72-page guide book, "Successful Patents"; "Stepping Stones" (containing hundreds of inventions wanted, etc.); and "Patent Promotion," (tells how to sell your rights; chief causes of failure, etc.) Send for them. Free manufacturing facilities. Advice free.
RICHARD B. OWEN, 164 Owen Bldg., Washington, D. C.

PATENTS ADVERTISED
In Popular Mechanics Magazine **FREE** if secured through our Credit System. Send sketch of invention. Free search.
100 PAGE BOOK FREE
WATERS CO. 4287 WARDER BLDG. WASHINGTON, D. C.

The Most Powerful Nipper Made
"RED DEVIL" No. 542—6½ in.
One lb. pressure in handles produces 20 lbs. power in jaw. Cuts the toughest wires with least strain. Made of drop-forged steel. Sample 85c. *Tool Booklet Free*
SMITH & HEMENWAY CO., Inc.
107 Chambers St. New York City

in his stationary gasoline engine, and he wishes to know whether it would not be possible to compress the natural gas into a tank of suitable size in order to drive the automobile.

(A) Anything is possible and there is no question that a scheme of this kind will work to a certain extent. The great question, however, is, how far can an automobile run on natural gas even if it should be compressed into steel cylinders. The weight of such cylinders would be quite high and we doubt if 10 miles could be covered with such an apparatus. However, in certain cities where natural gas costs practically nothing, it might be possible to exploit an idea of this kind. But it would hardly be practicable for cities, where natural gas is unobtainable. As to patenting a device of this kind, we doubt very much if the patents would be worth much to the owner.

STREET CAR INDICATOR.

(107.) W. N. Thompson, New York City, has devised a street car indicator whereby the next street reached will automatically appear on a certain device in the car without the necessity of its being watched by the conductor. He wishes to know whether a device of this kind is satisfactory and whether it can be patented.

(A) There are one or two such devices on the market and some of the European cities have tried them. But, to our knowledge, no great headway has been made. It is comparatively simple to manufacture a device of this kind, and if the car would always run perfectly even, all that would be necessary would be to affect a transmission from the axle of the car to the device and theoretically this should work out perfectly. Unfortunately, this never appears to be the case in practice, for the simple reason that the car wheels going around curves experience more or less slippage. Also, on a wet day the car wheels make a great many more revolutions than they do on a dry day on account of slippage also. Consequently, the indicator would indicate a certain street long before the street in question was actually reached, and if the distance traveled by the car is long enough, the information conveyed to the passengers would be entirely wrong. This is what inventors have not as yet worked out satisfactorily. It is worth while tackling.

AUTOMATIC SELF-STARTER.

(108.) Robert Fisher, Arkansas, has submitted an elaborate sketch and drawing of an automobile self-starter which works on the principle of coiling a large powerful spring which is automatically wound by the engine when it gains speed. The energy of the spring would afterwards start the engine when required to do so.

(A) This is a very doubtful idea and we do not think that a spring could be made which would work satisfactorily for any length of time on a device of this kind. Of course very powerful springs could be constructed to start turning the motor, but we have our doubts as to whether the device would be practicable and whether in the end it would not cost more than the present starting means.

MULTIPLEX TELEGRAPH SYSTEM.

(109.) Chase Hutchinson, Knoxville, Tenn., sends us a sketch and description of a multiplex telegraph system. He wants our advice on same.

(A) Devices of this kind are not practicable. We think the expense is too great to warrant practical use in exploitation and also because harmonic relays are too costly.

MAGAZINE DONATES $10,000.

Our Readers May Profit by Generosity of Western Magazine Firm.

A well known Denver publishing house has appropriated $10,000 to be used solely in a whirlwind circulation campaign. Their offer is so liberal and the magazine so interesting that everybody is eager to send in their names.

The magazine referred to is 13 years old and each month publishes stories of adventure, numerous engravings and sketches of western life, cowboy capers, descriptions of famous ranches, irrigation projects, land news, rich gold mines, etc., and tells how and where to get homesteads. It is the oldest, largest and finest magazine in the west. Readers say it is worth $3, but in this surprising circulation campaign the publishers are spending their money like water and our readers may subscribe three whole years for only 25 cents, six full years for 50 cents. It is the biggest honest offer ever made. Remit in cash, postage stamps or money order. Tell all your friends. This offer may not appear again. Send today. Money back if not delighted. Mention the Electrical Experimenter and address **Rocky Mountain Magazine Station 2, Denver, Colorado.** (Adv.)

PORCELAIN
"THAT'S OUR BUSINESS"
Standard and Special Shapes, Regardless of How Difficult

We illustrate one hard shape we make. A pair of rolls 7½" long and 1¼" in diameter with 8 holes on ends and middle. They must be perfectly straight and we make them so. It's hard but not for us. We can make your difficult designs also. Send us blue print for quotations.

Union Electrical Porcelain Works
TRENTON, N. J.

Experimental and Model Work
ELECTRICAL INSTRUMENTS AND FINE MACHINERY
Inventions developed. Special Tools, Dies, Gear Cutting, Etc.
HENRY ZUHR
32-34 Frankfort Street New York City

GROBET SWISS FILES

Are the standard of excellence in files, and have been for over 100 years. We send postpaid as an introducer 48 files especially adapted for tool makers and machinists on receipt of $5.00. This is a chance to get a set of files you'll appreciate and we'll get future orders.
MONTGOMERY & CO.
100 Fulton Street New York City

Reliable Supplies for WORKING MODELS
are fully described in our interesting, new illustrated **50-PAGE CATALOG**, 5c. postpaid. Write today for a copy. **SPECIAL ORDERS** are promptly and carefully executed by our mechanical department. Submit us your drawings and specifications for quotations.
IDEAL AEROPLANE & SUPPLY CO 76-82 W. B'dway, N. Y.

$125.00 to $300.00 a Month
Write at once. Most wonderful opportunity for the ambitious man. Railroads need hundreds of Signalmen—will pay Big Money.

Special Offer We will teach you *right at home* to be expert. Special offer if you write at once. Two big outfits free. Write Today for our free catalog and particulars of our big offer.
DEPARTMENT OF SIGNALING
1810 Wilson Ave. Room 3388 Ravenswood Station, Chicago

WIRELESS AND AEROPLANES AID EUROPEAN "GUN-SPOTTERS."

(*Continued from page 469*)

a hill is a common occurrence on many of the battle fronts of Europe, and it is one of the standard exercises proscribed for the artillerymen of the United States Army.

As aeroplane radio sets have been greatly improved since the start of the present European war, it is now feasible for aeroplanes to maintain reliable radiocommunication over distances of forty to fifty miles. Some of these wireless sets operate on batteries, but the majority of them are designed to be excited from a small dynamo driven by the aeroplane engine. Aeroplane radio sets of American design are being turned out which do not weigh above fifteen to twenty pounds. Specially designed receiving sets are supplied for aviators, combining a leather helmet with the sensitive telephone receivers in-built to form an integral part of the entire head-gear. The antenna on aeroplanes has to be especially well insulated and many freak arrangements of the aerial conductors are to be seen. A single wire depending downward from an automatic take-up reel is extensively favored. In other cases the antenna is spread over the length and breadth of the machine, and suitably supported so as to be clear of grounding on the metal parts of the aeroplane frame and engine.

LIGHTNING MADE TO ORDER.

(*Continued from page 474*)

volts and a frequency of one hundred thousand per second! The flame-like discharge measures sixty-five feet across. This experiment was performed for the purpose of showing how the nitrogen of the atmosphere could be made to combine with the oxygen. The large wire cage measured 20 feet in diameter and 30 feet in height. This is not the actual coil which is excited by the primary of the Tesla transformer, but a separate helix which is attuned to a certain frequency of the secondary of the transformer. This is apparent by noting the large circular fence-like wall in the rear, which measures 60 feet in diameter and which is wound full with heavy copper wire.

The primary is carefully imbedded in the ground and connected with the regular oscillating circuit, comprising high tension oil condensers and the inductance incorporated in the primary of the Tesla transformer, also a spark discharger. In all these experiments the primary of the low tension transformer was excited with 300 kilowatts of electrical energy.

A very striking experiment showing the emission of an electrical discharge from a large sphere is shown in Fig. 2. The ball has a surface of twenty square feet which represents a large reservoir of electricity. The inverted circular pan underneath with sharp rim has an opening thru which the electricity can escape before filling the reservoir. The quantity of electricity liberated is so enormous that, although most of it escapes thru the rim of the pan or opening provided, the ball of the reservoir is nevertheless alternately emptied and filled to overflowing, as is evident from the discharge escaping on the top of the ball.

The coil shown in Fig. 3 creates an alternative movement of electricity from the earth into a large reservoir and back, at the rate of one hundred thousand pulsations per second. The adjustments were such that the reservoir fills and bursts at each alternation just at the moment when the electrical pressure reaches the maximum. The discharge escapes with a deafening noise, striking an unconnected coil twenty-two feet away, and creating such a disturbance of electricity in the earth, that heavy sparks an inch long were drawn from the water main at a distance of three hundred feet from the laboratory.

One very interesting experiment conducted by Dr. Tesla showed how it is possible to tune several coils to different frequencies with respect to the fundamental frequency generated by the main exciting coil. A photograph showing this experiment is reproduced at Fig. 4. The large coil on the right, discharging strongly, is tuned to the fundamental vibration which is fifty thousand cycles per second; the two larger vertical coils to twice that number; the smaller coils, wound with white wire, to four times that number and the remaining small coils to higher harmonics. The vibrations produced by the oscillator were so intense that they affected perceptibly a small coil tuned to the twenty-sixth harmonic above the fundamental.

The scientific world is keeping its eyes peeled for the next epochal movement in the problem of transmitting energy *via wireless*. And the world expects Dr. Nikola Tesla to do this.

UNCLE SAM'S NEW 40-MILE AN HOUR "ELECTRIC" BATTLE-CRUISER.

(*Continued from page 479*)

spray burners, as compared to the bulky Scotch boilers as installed on the Cunard liner, the *Lusitania*. The *Lusitania* developed 70,000 H.P. maximum from her power plant, with a resultant speed of somewhat over 25 knots per hour. This vessel measured 790 feet in length with a 98 foot beam.

Not only have the technicians of Uncle Sam's Naval Construction Board evolved something startling in the form of a wonderfully fast battle-cruiser, but they will carry something entirely new in heavy ordnance.

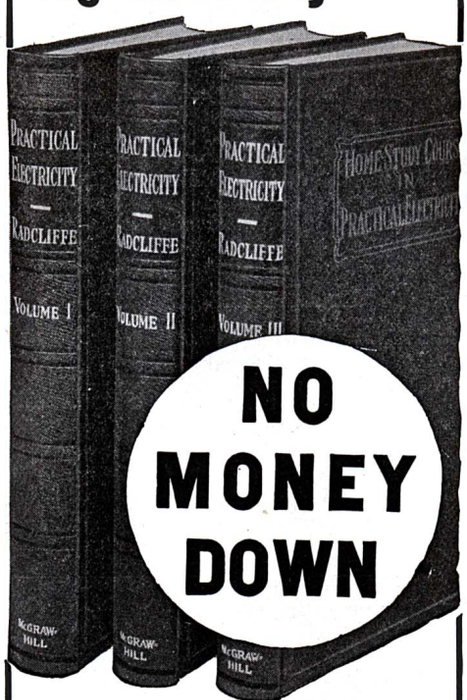
The big gun armament of these battle-cruisers will comprise eight 16 inch, 45 caliber rifles of a new type but recently developed by the U.S. Navy. It is said to be the most powerful gun in the world, firing a 2,400 pound shell with an initial velocity of 2,600 feet per second, or with an initial energy of 100,000 foot-tons.

Hence, when the officer in command presses an electric button that discharges a salvo from this mighty fighter of the seas, there will be represented a force of 800,000 foot tons, from the big gun battery alone—not to mention the secondary battery of six-inch and smaller caliber rifles, which will line the gun decks of the 900-foot armored hull. Thus, the primary battery of 16-inch rifles will develop sufficient energy to lift 2,000,000 pounds, 800 feet into the air. These large caliber rifles can be made to fire once every minute and faster when necessary. They will have about 25 degrees maximum elevation and a possible fighting range of approximately 30,000 yards.

It has been declared by naval experts that so remarkable is this new 16-inch gun, that under favorable conditions it would be possible to plant successive salvos on an enemy ship with accuracy, at a range of 25,000 yards.

The most important functions cared for by electricity on the modern battle-cruiser or dreadnought of the class above described are partly shown in the accompanying illustration with each particular part numbered, so that those interested can readily locate the most important general features of this truly wonderful craft. The key numbers start with the anchor hoist on the forward deck, just in front of the forward 16-inch gun turret. We will consider here simply a few of the more interesting and vital features involved in

Revolutionizing the methods of teaching electricity



Radcliffe's Home Study Course in Practical Electricity being founded on actual electrical work, is now gradually and surely taking the lead in popularity over all other electrical books of the kind.

We can show you, without your spending one cent, just why this is so—why you are losing valuable time every day you go without this library.

No matter in what subject you are interested, you want to grasp the principles of that subject as quickly as possible. Accuracy in knowledge is the first consideration—and second comes speed. From the Home Study Course you gain only accurate information about actual work, and you gain it speedily. There is no useless theory nor higher mathematics to hold you back. You go forward quickly, and learn in a short period, that which the author has spent years in finding out, and you pay

$6 FOR THE ENTIRE COURSE
At $1 Per Month

The coupon below brings the three volumes, beautifully and strongly bound, for ten days' examination. Send no money with order. Commence paying $1 per month only after you have satisfied yourself that you can master electricity with the aid of these books.

A Few of the Important Subjects Covered:—VOL. I—Leading Principles. Electrical Units. Conductors and Insulators. Calculation of Resistance. Electrical Circuits. Primary Battery Cells. Storage Battery Cells. Magnetism. Electromagnetic Induction. Direct-Current Generators. Alternating Currents. Alternating-Current Generators. VOL. II—Transformers. Electric Measurements and Instruments. Switchboards. Switchboard Wiring and Operation. Station Wiring. VOL. III—Direct-Current Motors. Alternating-Current Motors. Motor-Generators, Dynamotors and Rotary Converters. Incandescent Lamps. Arc Lamps. Substations. Management of Electrical Stations.

----Free Examination----

McGRAW-HILL BOOK COMPANY, Inc.,
239 W. 39th St., NEW YORK

Gentlemen:—Send to me, charges paid, the Home Study Course in Practical Electricity, three volumes, price $6. I agree to examine the books and if satisfactory will remit $1 in ten days, and the balance at the rate of $1 per month. If books are not wanted I will write you for shipping directions.

Signature.....
Your Address.....
City and State.....
Name of Employer.....
His Address.....
Your Position.....E E Nov.

$1.00 BY MAIL HOMANS' FIRST PRINCIPLES OF ELECTRICITY

By J. E. HOMANS
Author of "A. B. C. of the Telephone" "Self-Propelled Vehicles," etc.

As either a primer of electrical science, or as a handbook of fundamental principles that would be appreciated even by an advanced worker, this book is in a class by itself.

BOUND IN CLOTH, FULLY ILLUSTRATED

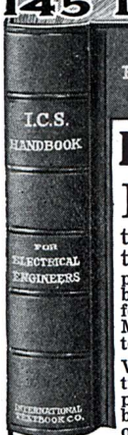
In the same series at $1.00 by mail

HOMANS' AUTOMOBILE HANDBOOK

SULLY AND KLEINTEICH

375 FOURTH AVENUE NEW YORK CITY

414 PAGES 145 ILLUSTRATIONS



50¢

ELECTRICITY!

HERE'S just the book on Electricity that you need to answer your many questions—to solve your knotty problems, to teach you new kinks, to be your memory for tables, rules, formulas and other Electrical and Mechanical facts that some people try to carry in their heads—and fail.

With this "Little Giant" I. C. S. Electrical Engineer's Handbook in your pocket, tool chest, on your work bench, drawing table or desk, an hour or a day need not be lost "digging up" some forgotten rule, some unfamiliar fact; you'll just turn to the very complete index and get it "in a jiffy." Just a few of the subjects treated are:

Electricity and Magnetism; Electrical Symbols; Batteries; Circuits; Magnets; Direct and Alternating Currents; Dynamos and Motors; Belts; Shafting; Electroplating; Electrical Measurements; Meters; Arc and Incandescent Lamps; Mercury Arc Rectifiers; Transformers; Insulation; Electric Cars; Single and Multiple-Unit Control; Transmission; Rail Welding; Tables of Wires—Sizes, Capacities, etc.,—Mathematical Rules, Formulas, Symbols; Tables of Constants, Equivalents, Roots, Powers, Reciprocals, Areas, Weights and Measures; Chemistry; Properties of Metals; Principles of Mechanics; First Aid, etc.

The Electrical Engineer's Handbook is one of 22 I. C. S. Handbooks covering 22 Technical, Scientific and Commercial subjects, all crowded with value. They have the contents of a full-size book condensed into pocket-size ready to go with you anywhere and be at your instant command. They are substantially bound in cloth, red edges, goldleaf stamping, printed from new, clear, readable type on good quality book paper. There is an illustration at every point where a picture will help. Hundreds of thousands have been sold on a money-back guarantee of satisfaction.

The regular price is $1.25, but for a LIMITED TIME you can buy the ones you want, postpaid, delivery guaranteed, for only 50 cents.

You Run No Risk! Money Back if Desired!

International Correspondence Schools
Box 5324, Scranton, Pa.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 5324, SCRANTON, PA.

I enclose $_____ for which send me postpaid the Handbooks marked X, at 50c. each. I may return any or all and get my money back within ten days from receipt:

☐ Electrical Engineer's	☐ Advertiser's
☐ Teleph. and Teleg. Engineer's	☐ Business Man's
☐ Mechanic's	☐ Bookkeeper's
☐ Steam Engineer's	☐ Steno. and Correspondent's
☐ Westinghouse Air Brake	☐ Salesman's
☐ Civil Engineer's	☐ Window Trimmer's
☐ Coal Miner's	☐ Cotton Textile Worker's
☐ Concrete Engineer's	☐ Farmer's
☐ Building Trades	☐ Poultryman's
☐ Plumbers and Fitter's	☐ Mariner's
☐ Chemist's	☐ Automobile

Name _____

Street and No. _____

City _____ State _____

the control and operation of these new electric battle-cruisers.

As already mentioned, the power plant will depend upon oil fuel instead of coal. A large battery of water tube boilers, as shown in the drawing, will produce a high-pressure steam and this is fed into the turbines, which are directly connected to the electric generators. These, in turn, are electrically connected to the main distribution switch-board in the engine room. This switch-board contains the necessary measuring instruments such as voltmeters and ammeters, also protection apparatus such as circuit-breakers, etc. There are a number of auxiliary switch-boards besides, the principle function of which is to serve as remote control boards for the circuits running between the conning tower or bridge, just back of the forward 16-inch gun turret, and the propelling and steering motors.

The entire equipment, or, at least the propelling and steering functions inherent to it, may be controlled from either the bridge or the armored conning tower just below the bridge, and in event of the superstructure of the vessel being shot away in battle, the boat is still immune because of a third pilot room, located several decks below the conning tower, in a well-protected position as shown in the illustration. Thus, the vast difference between this modern, electrically propelled and steered vessel, and the older, steam-driven types, becomes readily apparent, as in the older fighting ships the officers on the bridge or in the conning tower, had to give the men in the engine room the necessary orders by means of an *engine room telegraph,* as it was called. In these new craft, thanks to the high efficiency and positive action inherent to control by electricity, those in command on the bridge, for instance, can handle the vessel directly by means of suitable switches and tell-tale annunciators located before them.

The electric steering equipment is of interest on these new ships, the rudder being swung either to right or left by means of electric motors controlled from the bridge or conning tower. And the exact position of the rudder at any instant is made manifest by means of a multi-segment switch mounted on the rudder post, which controls a lamp annunciator on the bridge. The swing of the rudder from right to left is divided into a number of small divisions each corresponding to several degrees of the helm arc. Each division is indicated by a certain annunciator lamp, which lights up when the rudder lies in that particular angle.

Suppose one of these fighting monsters to be steaming lazily along at sea, when suddenly a radio message is received (in either one of the two radio operating rooms shown in the illustration). And further consider that the radio message is important, stating, for example, that enemy war vessels are but a short distance away. Then, the all-important question to the layman is—Just what does happen in order to get the fighting ship into battle trim instantly?

The officers and lookouts on the bridge and at the mast-heads, begin to scan the sea with their telescopes for the first sight of the enemy. As soon as the radio order has been received by the officer in command, he transmits the necessary instructions to his subordinate officers. One of these men, by simply pushing an electric button on the bridge of the ship, causes general alarm bells to sound throughout the entire vessel. The sailors, gunners, engineers and others may be lounging about the ship, but the instant these electric gongs

WANTED MEN!

$75 TO $300 A MONTH!

Demand for capable automobile and tractor men far exceeds the supply. Our graduates secure good paying positions as Salesmen, Demonstrators, Factory Testers, Garage Managers, Drivers and Tractor Experts.

$50 Course FREE

Only six weeks required to train you in this great school. Most complete instruction. Instructors all experts. Enroll now and receive $50 Course in Tractor and Lighting Engineering Free. Write today for our big Free Book and $50 Free Scholarship Certificate.

RAHE'S AUTOMOBILE TRAINING SCHOOL
Largest Auto Training School In the World.
512 E 11th St., Kansas City, Mo.

Y. M. C. A. RADIO SCHOOL

Has positions open *now* for first grade commercial operators.

Fall classes forming, opening in October.

Instruction by Chief Radio Inspector of United States and first grade operators. Equipment includes all standard transmitting and receiving apparatus. Code practice given directly from Nauen, Honolulu, etc.

Good Pay. Pleasant Work. Travel.

Enroll now. Booklet on request.

Y. M. C. A. RADIO SCHOOL
145 East 86th St., New York, N. Y.

Jensen Electric Company

Radio Apparatus and Supplies

1949 Huron St., Chicago, Ill.

Don't Wear a Truss

BROOKS' APPLIANCE, the modern scientific invention, the wonderful new discovery that relieves rupture will be sent on trial. No obnoxious springs or pads. Has automatic Air Cushions. Binds and draws the broken parts together as you would a broken limb. No salves. No lies. Durable, cheap. **Sent on trial to prove it.** Protected by U. S. Patents. Catalogue and measure blanks mailed free. Send name and address today.

C. E. BROOKS, 203 State Street, Marshall, Mich.

WIRELESS OPERATORS SEE THE WORLD

Positions always open. Good salaries. Day and evening sessions. Correspondence courses. Wireless apparatus for home use. Send for illustrated catalogue.

Phila. School of Wireless Teleg.
10 Parkway Bldg., Philadelphia, Pa.

AGENTS $60 WEEKLY

Robinson Folding Bath Tub. Big seller. Costs little, no plumbing, little water. Weight 15 pounds, folds into small roll. Full length baths, far better than tin tubs. Guaranteed 10 years. $10 day easily made. Write for free tub offer.

Robinson Cabinet Mfg. Co 241 Factories Bldg., Toledo, Ohio

begin to sound, they proceed immediately to their assigned battle quarters. The gunners are at their proper places in a few seconds. The decks are cleared of all their railings and loose fittings, such as life rafts or boats, including the life boats and launches on the super-structure, in proximity to the smoke stacks. If the decks are covered with wood, this is removed and thrown overboard, as it was found, in the Spanish-American War, that more damage ensued from the flying splinters of wood hit by shells, than from any other cause. Some of the splinters even entered the gun turrets through the gun loop holes. Also, there is constant danger of a conflagration when wood is present, so the imperative order now-a-days is to immediately dispose of any wooden object by casting it overboard. The fighting monster is thus entirely sheathed in steel, and a clear way is made in all directions for the cannon-fire. The general alarm gongs keep ringing periodically every few seconds, and in but a few minutes' time after the enemy has been reported, the fighting craft is ready for action.

If desired, the officers give the order to those in the boiler room to regulate the machinery, drafts, etc., so as to cause heavy black smoke to roll from the stacks. This move is often necessary when other ships are to be screened from the enemy temporarily, or even to help conceal the vessel herself. For battle trim, the radio operators move their headquarters down to the *battle* radio room, located on one of the lower, protected decks, as shown in the illustration. This room is specially built with sound-proof walls and a door that cuts off all sound. Fresh air is pumped into the chamber by an electric blower, so that very little sound of the cannon discharges can be heard.

In the preparations for battle the electricians have been among the busiest men on board. One of their principal duties is to lower over the side of the hull the two auxiliary aerials; one on the port side and one on the star-board side. Thus, there are three radio antennæ in service, and the enemy has to shoot down the port and star-board aerials and also that between the mast-heads, before radio communication is cut off entirely. There are also provided sensitive, electric microphones for the detection of approaching submarines or other vessels, these instruments being placed, of course, below the water line. Submerged torpedo tubes are also ready for service, both fore and aft. The gunners, as well as those in the torpedo rooms, wear telephone receivers on their heads, which are connected up with the fire control officer located on the bridge or in the conning tower.

The push of a button on the bridge and the ammunition room door whistles sound; a short time after the doors close, a telltale lamp before the officer acquainting him with the fact.

As soon as the enemy comes within range the fact is communicated over the telephone system connecting the range finder officers, located atop the shell-proof, basket masts, to the gunners below. As soon as he has found the range, which takes but a few seconds, the man at the range finder telephones the corresponding distance, as well as the wind velocity and other necessary information to the gunners throughout the ship.

Everything goes like clock work, and although it takes several minutes to read just these few lines, all of the operations here cited and a hundred others take

50¢ a Week

YES, for this insignificant sum you can get the great 1916 edition of the **Cyclopedia of Applied Electricity.** See it before you decide to buy. No matter what you want to know about electricity—here it is at your fingers' tips. The great authorities have written it in plain English—so that you can grasp it instantly. These books mean more money for you—promotion—the position you have been dreaming about, and all you need to do to get the entire seven volumes is to send us your name and address. Use them seven days at our expense before you decide if you want to buy.

All About Electricity!

The 1916 edition of **Cyclopedia of Applied Electricity** contains 3,500 pages, 7x10 in.; 3,000 illustrations, full-page plates, diagrams, etc.; hundreds of valuable tables and formulas; carefully cross-indexed for quick, easy reference. Printed on special quality paper and bound in half red morocco, gold stamped. Seven volumes. The standard of America—the information that is vital to *you* and to every man who is interested in electricity. And it is yours—on a startling offer.

Read These Subjects

Elements of Electricity—Electrical Measurements—Underwriters' Requirements—Theory, Calculation, Design and Construction of Generators and Motors—Dynamo-Electric Machinery—Lighting Machinery—Power Transmission—Electric Railways—Power Stations—Switchboards and Switching—Storage Batteries—Applied Electro-chemistry—Electric Elevators—Electric Welding and Heating—Wire and Wireless Telegraphy.

Shipped FREE!

Don't send us a penny. We will send the entire seven volumes **prepaid** right to your home, so that you can see and examine them for yourself. **Keep them seven full days.** Then decide if you can get along without them. If you think you can, send them back. If you keep them, pay $2.00 after the seven days' trial—and then $2.00 a month (50c a week) until $19.80 has been paid. You are the sole judge—you do not risk a penny. This offer is open to everyone in the U. S. and Canada.

Consulting Service FREE!

A year's Consulting Membership (regular price $12.00) will be given free if you send your order at once. The advice of an entire corps of electrical experts is yours—to help you in your progress—for a whole year **FREE!**

Send the Coupon

See these books for yourself before you decide to buy. Remember—don't send us a penny. Just fill out the coupon and mail it. Will send you the entire seven volumes *prepaid.* Use them seven days—then if you want to buy pay the special reduced price at the rate of $2.00 a month. Send the coupon now. Your ambition says—act—see for yourself.

AMERICAN TECHNICAL SOCIETY
Dept. E. 3388 CHICAGO, U.S.A.

American Technical Society
Dept. E 3388 Chicago, U.S.A.

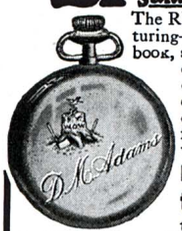
Please send me Cyclopedia of Applied Electricity for seven days' free examination. If I keep the books will send $2.00 within seven days and $2.00 a month until $19.80 has been paid, when books and Consulting Membership will be mine. Otherwise will notify you and hold books subject to your order.

Name.....

Address.....
As I have had no previous dealings with you, I refer you to

.....

21 JEWEL "Santa Fe Special" $3.50 A MONTH



The REAL Triumph of watch manufacturing—Write NOW for **FREE** watch book, showing newest case designs in 4 colors. Read the so-called **secrets** of watch making. Read how **you can save** from **one-third** to **one-half** of your money. Buy "Direct" at factory cost — cutting out the wholesale Jeweler's profit.

Buy the Best Railroad Watch the "Santa Fe Special"

the only watch that's **"Guaranteed for Life,"** thin model, all sizes, **adjusted** to positions, **adjusted** to isochronism, **adjusted** to temperature, **adjusted** to the second.

SEE THIS WATCH FIRST
Sent Without One Penny Down

EASY PAYMENTS to suit you. Write today. Your name on a postal brings the FREE watch book.

SANTA FE WATCH COMPANY, Dept. N-29, Topeka, Kan.

place with absolute precision in a few seconds.

If the enemy ship presents a suitable target for a broad-side or *salvo,* the officer on the bridge so informs the gunners in all the big-gun turrets. These can be swung either to port or starboard for firing a broad-side. The gunners at the 6-inch and smaller rifles on the gun decks amidship are notified when a full broad-side is to be fired.

Salvo firing can be controlled very accurately, when necessary, by telephone, and the guns are fired (electrically) by the individual gunners, on what is termed in naval verbiage—the *salvo buzzer.*

It is usual for medium size guns, such as the 6-inch rifles, to be required to fire within 5 seconds after the salvo buzzer sounds; 5 seconds being allowed for reloading. This makes an average of 6 shots per minute. The heavier, 16-inch rifles, of course, cannot fire so fast and a special circuit controls the salvo buzzers in all the turrets.

Thus, the entire fighting ship is soon put under the dominant control of the officers in command on the forward bridge or in the conning tower. They may run the vessel ahead or astern. When they deem it the psychological moment for a broad-side, they have but to press a button, and before they can count 10, there will be hurled forth from the brazen throats of the mighty guns an avalanche of shot and shell representing over 2,000,000 foot-tons of energy—sufficient to blast any ordinary war vessel clear out of the water.

In the gun turrets, electricity is the all-important factor, as it proceeds to go about its duties in a noiseless and uncomplaining manner. The gunner behind the breech of the 16 inch-20 mile gun has but to push a button when this mighty steel cannon rapidly rises or falls, just as he desires. Pushing another button causes the turret to revolve and stop at any desired angle or fraction thereof. Electric motors revolve the turret by means of rack and pinion. The telephone receiver gives him telephonically the range and angle functions as obtained with the range-finding instruments located atop the observation masts, as well as from range-finders on other parts of the vessel. The electric firing buzzer gives him the signal for discharging the gun. Loud-speaking telephones are used for all such communications in many instances, particularly for giving orders between the turret chamber and the ammunition rooms, several decks below.

The whirr and buzz of electric motors is heard as they hustle the 16-inch shells turret-ward. And so, as we go over the ship from stem to stern, we find electricity performing a thousand and one wonders here —there—everywhere.

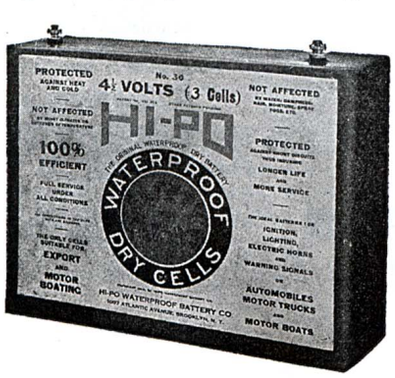
In moments of lighter vein when the Jackies are taking life easy, you may see how electricity is used for all the domestic requirements on board ship, whether it is for washing dishes or peeling potatoes in the kitchen, or turning a lathe in the machine shop. Again, perhaps we hear the whirr of a motor as it busily revolves one of the rotary clothes washers in the laundry. And so we come to know that it is electricity that ventilates, drives, illuminates and steers this wonderful creation of the human brain—the greatest naval advance in a decade. Once we were content to read about 40 mile per hour motor-boats, but here we are face to face with a 900-foot, honest-to-goodness, hell-raising sea fighter that can dash down on the enemy with express train speed and lash the devil out of him with broadsides of 16", armor-piercing shells. Even the Kaiser will have to rub his eyes and blink at Uncle Sam's latest "peace-inspiring" persuaders.

BEACON
TRADE MARK
BEACON ELECTRIC WORKS
OF NATIONAL CARBON COMPANY
132-138 KING STREET, NEW YORK
11-17 S. DESPLAINES STREET CHICAGO
156 SECOND STREET SAN FRANCISCO
"BUY A BEACON AND BE GUIDED RIGHT."
ALADDIN BATTERY
Unexcelled in Durability and Electric Energy

HI-PO
WATERPROOF DRY CELLS

And Ready for Use **CONNECTED SETS**

Highest quality and absolutely protected against moisture, dampness, fog and spray. Give 100% service even when standing in water.



Set of 4 cells (5 volts) **$1.60**

Set of 6 cells (9 volts) **$2.40**

Other sets in same proportion

The only guaranteed and original waterproof Dry Battery.

Beware of Imitations.

If your dealer does not handle our goods, send us his name with your remittance.

No. 6 Cells 35c. each

HI-PO Waterproof Battery Company
1007 Atlantic Avenue, Brooklyn, New York

TESLA VS. MARCONI COMPANY.

The answer of the Marconi Wireless Telegraph Company to the suit of the Nikola Tesla Company for an alleged infringement of its patents, was filed recently in the Federal District Court. The Marconi Company denied that Mr. Tesla was at any time the original or first inventor of the alleged new and useful method of signaling set forth in the complaint. The answer also denied that the patents issued on March 17 and April 14, 1903, were duly or lawfully granted to Mr. Tesla, because he had not complied in all respects with the conditions and requirements of the patent laws. The defendant company asks that the complaint be dismissed.

JAMES CLERK MAXWELL.

(*Continued from page 471*)

had taught in London only eight years when the state of his health became such as to force his retirement to his country estate in Scotland. Somewhat improved by his stay there, he became professor of experimental physics at Cambridge, in 1871. Only eight years later he died at the age of forty-eight.

At the International Electrical Congress, held in Paris in 1900, the memory of Maxwell was honored in giving his name to the unit of flux in a magnetic circuit—this unit corresponding to the ampere in electrical circuits.

WHEN AMATEUR WIRELESS WAS YOUNG.

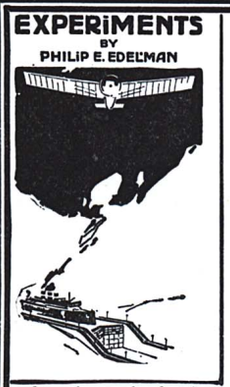
(*Continued from page 488*)

scene of ye scribe's activities shifted to the city of brotherly love, Philadelphia. Here, after his miscellaneous "junk" and other paraphernalia had been ensconced in one of the famous (or is it infamous?) old boarding houses, that line Spruce Street, many wild dreams presented themselves to his imagination. One of the most pertinent of these was, that no longer would the old shellacked, two by nothing receiving cabinet suffice. Nothing to it—it must go. And it did, giving way to a most wonderful and fearful receiving "set." To begin with, this was to be a real outfit; one of those affairs that caused even your friends to throw up their hands and exclaim in wonder "What's this for?" and "What's that for?" and "Why do you have to use this?" and so on, *ad infinitum*, for about half an hour. By this time, after having read a number of books on the subject, there were, of course, always some *new* ideas to be added or incorporated in the outfit. These ideas multiplied bewilderingly and threatened to even scare the writer in their enormity. Before long there were so many wires, switches, chokes, jiggers, shunts and condensers hooked up to the 5000 ohm, polarized relay and coherer, that it is really doubtful when a regular wireless wave of respectable power did manage to enter the aerial and ground terminal post on the handsome oak cabinet, whether it could find its way through the maze of apparatus.

This "set" was finally, however, tuned up in good shape and gave excellent satisfaction. The two-inch spark coil was usefully employed in giving demonstrations with it and two pieces of brass tubing about three feet long, served as *aerial* and *ground*, as most of the tests were made only through the wall between two rooms, or between the third floor and the first floor of the dwelling.

An amusing, albeit not very pleasant experience, comes to mind when on one occasion there was a lecture to be given with this set at one of the local high-schools. At the last moment the glass coherer tube cracked and all the precious gold, silver and nickel filings flew pell-mell over the edge of the table and on the carpet. This was a hopeless case indeed, for the moment; but, recollecting that not many blocks away there was a scientific instrument company who manufactured demonstration sets of radio-telegraphic apparatus, a call was made on them at once. To be sure, they would be only too glad to sell a *filling* for a coherer. After we had sworn by all the Holy Saints that our set was really one of their manufacture, and after waiting for about an hour for the arrival of the precious filings of unknown origin, they came to hand, and the bill nearly knocked off our hats. For they only wanted $2.00 for each *filling* and there were two fillings in the envelope, which the clerk politely stated to be the minimum order for them which they would handle.

One more experience will be related and



"Get Your Own Idea!"

"Stick to it and put all your heart and soul into it every day"

Such is the advice of Alexander G. Bell, inventor of the telephone, at 70 years to the young man of today. Ideas come from learning about new things—how others accomplished wonders. And now comes Philip E. Edelman with a new book to help you get "your idea."

You are already interested in science generally, else you would not be reading this magazine. Stop wondering—learn how marvels are devised by human brains. Don't "just putter around." Make your work and hobby count for something. In China, you know, it takes two men to dig a shovelful of dirt—one to push the spade in and one to pull it up with a rope. But in America, the land of scientific experiments, a single steam shovel does the work of a thousand Chinamen. Don't imitate the Chinamen. Don't waste your time in useless endeavors. Let Edelman's "Experiments" show you how before you try to go ahead. Don't be satisfied another minute without getting this book. The edition is limited. Telegraph your order, if necessary, but for your own sake do not fail to get your copy of

"EXPERIMENTS" only $1.50 PREPAID

By PHILIP E. EDELMAN, Author of "Experimental Wireless Stations"

CONTENTS: **256 pp., 34 chapters; profusely illustrated with tables, charts, half-tones and engravings. Price $1.50 in cloth or $3.00 in leather prepaid. "The greatest 'how to make it' book."**

Book 1. Models, Copies and Makeshifts. 2—Simple Chemical Experiments. 3—Miscellaneous Applications of Chemicals. 4—Catalytic Experiments. 5—Deposition of Metals and Electroplating. 6—Electrochemistry. 7—Electric Motors. 8—Electric Heating Devices and Experiments. 9—The Electric Arc-Welding and Talking. 10—Simple Electrical Devices. 12—Electrical Transformers, Induction Coils and Applications, including an Ozonator. 13—Wireless Telegraphy, Telephony and Control Apparatus. 14—Telegraphy and Picture Transmission. 15—High Frequency Apparatus and Experiments. 16—Phosphorescence and Ultra-violet Light. 17—Experiments with Graphite. 18—Radiography and X-rays. 19—Electrical A. C. and D. C. Experiments. 20—Static Electricity, Apparatus and Experiments. 21—Mechanical Devices and Physical Experiments. 22—Experiments in Horticulture. 23—Model and Applied Aeronautics. 24—Microscopes and Microscopic Photography. 25—Suggestions for a Laboratory.

Book 2. 26—Science and Invention. 27—Essential Processes in Experiments. 28—Fundamental and Experimental Principles. 29—Preliminary Experimental Work. 30—How an Original Research is Conducted. 31—Radio Research. 32—Simple and Industrial Testing. 33—Commercial Experiments. 34—The Tomorrows of Experimental Research. Index.

Experimenter's Library $2.85

consisting of "Experiments," complete in two parts, and "Experimental Wireless Stations," by P. E. Edelman. Gives full information every reader wants—chemical, electrical, wireless, mechanical, invention, etc. Former price, $3.50. Prepaid this month, only **$2.85.**

Philip Edelman, 1802 Hague Avenue, St. Paul, Minn.

COMMENTS: "If it be true that the value of a book, whether it deal with fiction or with science, lies in its power to evoke new thoughts and figures in the reader's mind, then this is a valuable book. The spirit of optimism which pervades it, together with its ability to awaken and stimulate the normally somnolent mind, should insure for it a wide circulation among an appreciative circle."—*Electrical World*, New York City.

"A very attractive series of experiments, selected with a view to making the student acquainted with modern progress and the way in which it has found itself, are presented with plates, engravings and half-tones in profusion."—*Scientific American*, New York City.

"A remarkably interesting work. The work is one which may prove the inspiration of some new Davy, Edison or Darwin."—*Electricity*, London.

This book is a year ahead of any similar volume; indeed—regardless of price—there is no other book like Edelman's "Experiments." "It is in a class by itself," says the *American Journal of Science*, New Haven. A coupon is attached for your convenience. Circular Free.

ORDER NOW

Mr. P. E. Edelman, 1802 Hague Ave., St. Paul, Minn.

I enclose $1.50 for "Experiments" (or $2.85 for "Experimenter's Library") which you will send prepaid absolutely guaranteed.

Name.....

Address.....

SEE OUR BIG SUBSCRIPTION OFFERS ON PAGES 541 AND 542

Boys! Here Is Your Laboratory!

CHEMCRAFT

$2.00

A Complete Outfit of
CHEMICALS - (39 Chemical Reagents)
APPARATUS - (All Necessary Apparatus)
INSTRUCTIONS - (The 36 page Chemcraft Book)
for performing over 50 Different Experiments. Each experiment can be repeated many times.

Under the heading "Chemistry and Its Application to the Industries" are many experiments in which the products of our great chemical industries are really manufactured on a small scale. Everything is explained in a clear interesting way.

Chemcraft also contains 30 mysterious experiments in **Chemical Magic.** It's great fun to show these to your friends.

With this outfit all experiments now appearing in "Experimental Chemistry" in the "Electrical Experimenter" can be performed.

If your dealer does not have Chemcraft we will send yours direct. **Price $2.00** postpaid. Send today for descriptive literature.

Dealers write at once

THE PORTER CHEMICAL CO., Hagerstown, Md.

Be a Doctor of Chiropractic

4 Lessons FREE!

These books tell of this wonderful science of spinal adjustment. Read like fiction, yet absolutely true. 30,000,000 Americans support Chiropractic. Thousands being cured of long-standing diseases by it.

Big Opportunity for Ambitious Men and Women. Resident and Home Study Courses. Large demand for practitioners—$2,000 to $5,000 yearly. **Small expense. Easy payments.** We fit you for State Board requirements. **FREE! Elbert Hubbard's** Book, "The New Science." Mail postal, get all five books FREE.

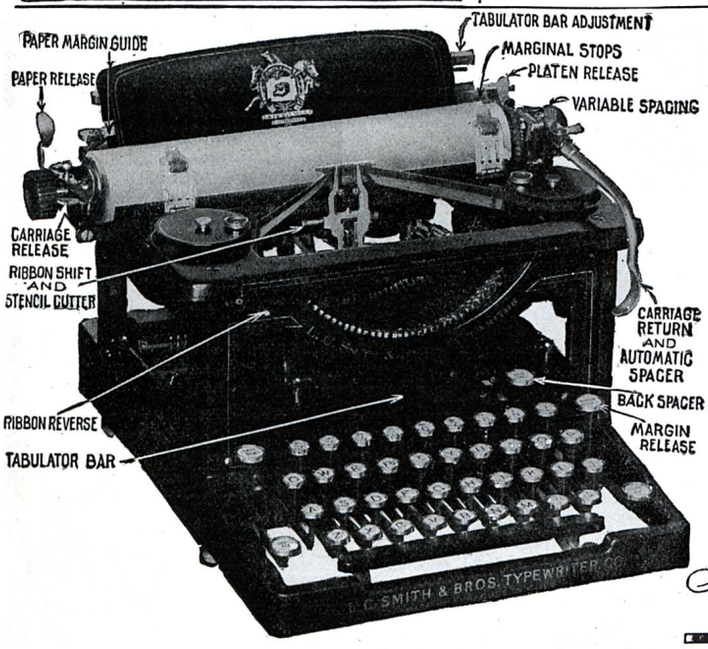
National School of Chiropractic
Dept. El 11 421 S. Ashland Blvd., CHICAGO

one which will be quite familiar to every electrical experimenter who has lived away from home, cooped up in one of those private *boudoirs de luxe* for which the honorable boarding house mistress has the courage to demand anywhere from 3 to 5 cold simoleons per week. In one of these almost civilized habitats the writer had the audacity to undertake the construction of a large spark coil. Every electrician knows what that means. For, if it is to be a regular coil, the secondary must absolutely be made in sections and of course the thinner the better, as we all know. Everything happened, and then some, in the ensuing month and a half during which the construction of the coil parts and particularly the secondary proceeded with all possible haste. Patience is a virtue, to be sure, but it has a doubtful and variable place in the vocabulary of the electrical experimenter. He no sooner starts to build an apparatus when he begins to anxiously long for the final moment when everything will be ready to throw in the switch and watch the results. The spark coil, which was to be an eight-inch one, got along famously until it came to winding the secondary pies, each of which consisted of several hundred turns of very fine silk covered magnet wire run through a molten paraffine wax bath, as they were wound on to the former.

Luckily, it was during the winter months that this exciting *indoor sport* took place, and though the author worked diligently at it, even to the extent of spending every evening and holiday on the job, it required well over a month until the 115th pie (God bless it) was finished. If you do not know what trouble is, then you simply have to try carrying out such an operation as this in someone else's home, yes, even in a boarding house. Paraffine wax is a very innocent looking commodity when it is solidified. But allow a fair-sized quantity of this important substance to be molten over a stove in a closed room and watch the results. Not only an uncomfortable amount of smoke is produced, but there is a rancid odor emitted with an unholy decrement, which has a persistent affinity for all doors, cracks and other openings. The reader may judge for himself of the howls and kicks made by the other occupants of the house while these *scientific* operations proceeded with all due haste. This haste was not altogether and totally due to the natural desire to see the final results of the spark coil, nor to the black looks and ungrateful remarks of those who passed the *laboratory* door, but distinctly and very pertinently to the fact that nothing but a gas light was supposed to be used in this *boudoir*. Finances had to be stretched in those days to the utmost limit in order to pay for the silk covered wire and other gadgets which were to adorn this masterpiece.

A gas stove bill could not be countenanced for one moment; hence there was always intense excitement whenever someone knocked at the door, for at that psychological moment everything, including and not forgetting the Bunsen burner which heated the wax, had to be heaved post haste into the nearest bureau drawer or into the trunk, and the key turned. And, what was worse, we had to conjure up a face which personified innocence itself, particularly when the caller who had so politely knocked at the door happened to be Her Royal Highness—the Landlady, sniffing suspiciously over the land!

Yes, those were the palmy days—but never again. The wife wouldn't stand for it.



I want, through this advertisement, to establish as friendly business relations with you as I possibly can. I want you to realize also, that it is my earnest effort and intention to give you full, honest value for every dollar that you spend with me. This is the only way I can succeed. The publisher of this magazine will vouch for my square dealings during the four years and more my advertising has appeared.

I am building up my business on the foundation of good value and square dealings. I am saving thousands of satisfied customers thousands of dollars by supplying perfect—late style—visible writing typewriters—at remarkably low prices.

All my transactions are handled throughout by personal correspondence. I assure you every courtesy and consideration in your dealings with me. Your order will have my prompt, careful, personal attention. I will be glad to do business with you,

Harry A Smith

TYPEWRITER SENSATION

Free TRIAL—Use as You Pay

Send me only $2.50 a month until the low total price of $48.80 is paid, and the machine is yours

This is absolutely the most generous typewriter offer ever made. Do not rent a machine when you can pay $2.50 a month and own one. Think of it—Buying a $100.00 machine for $48.80. Cash price $45.45. Never before has anything like this been attempted.

Standard Visible L. C. SMITH Model Number 2

Perfect machines, Standard Size, Keyboard of Standard Universal Arrangement, writing 84 characters—universally used in teaching the touch system. **The entire line of writing completely visible at all times,** has the tabulator, the two-color ribbon, with automatic reverse, the backspacer, ball-bearing type-bars, ball-bearing carriage action, ball-bearing shift action, in fact every late style feature and modern operating convenience. Comes to you with everything complete, tools, cover, operating book and instructions, ribbon, practice paper—nothing extra to buy. **You cannot imagine the perfection of this beautiful reconstructed typewriter until you have seen it.** I have sold several thousand of these perfect latest style Model No. 2 machines at this bargain price and everyone of these thousands of satisfied customers had this beautiful strictly up-to-date machine on 5 days' free trial before deciding to buy it. I will send it to you F.O.B. Chicago for five days' free trial. It will sell itself, but if you are not satisfied that this is the greatest typewriter you ever saw, you can return it at my expense. You won't want to return it after you try it—**you cannot equal this wonderful value anywhere.**

H. A. SMITH
Room 738
231 N. Fifth Ave.
CHICAGO, ILL.

Ship me a Number 2 L. C. Smith, F.O.B. Chicago, as described in this advertisement. I will pay you the $40.00 balance of the SPECIAL $48.80 purchase price at the rate of $2.50 per month. The title to remain in you until fully paid for. It is understood that I have five days in which to examine and try the typewriter. If I choose not to keep it, I will carefully repack it and return it to the express agent. It is understood that you give the standard guarantee for one year.

Name .....

Address .....

.....

You Take No Risk—Put in Your Order *Now*

When the typewriter arrives deposit with the express agent $8.80 and take the machine for five days' trial. If you are convinced that it is the best typewriter you ever saw, keep it and send me $2.50 a month until my bargain price of $48.80 is paid. If you don't want it, return it to the express agent, receive your $8.80 and return the machine to me. I will pay the return express charges. **This machine is guaranteed just as if you paid $100.00 for it.** It is standard. Over one hundred thousand people own and use these typewriters and think them the best ever manufactured. **The supply at this price is very limited, the price will probably be raised when my next advertisement appears, so don't delay. Fill in the coupon today—mail to me—the typewriter will be shipped promptly.** There is no red tape. I employ no solicitors—no collectors—no chattel mortgage. It is simply understood that I retain title to the machine until the full $48.80 is paid. **You cannot lose. It is the greatest typewriter opportunity you will ever have. Do not send me one cent. Get the coupon in the mails today—sure.**

HARRY A. SMITH
738–231 N. Fifth Avenue Chicago

THE MARVELS OF MODERN PHYSICS.

(*Continued from page 485*)

ted, and on the strength of this a wonderful station was built on Long Island. Every reader of scientific periodicals is familiar with its picture and history. At present it is deserted, but Tesla is still working upon the subject. The problem, however, is as yet unsolved. We will not say it is impossible of solution, for do we not have real wireless transmission of power as an everyday occurrence in the ordinary transformer? Though there is no metallic connection between the primary and secondary coils, yet there is an immense transfer of power at only a slight loss. Notice how near the ideal conditions are, however. The distance is negligibly small, and even the

medium itself is improved by the presence of a soft iron core. It is too common a fact for us to consider it wonderful, and yet the result is the same as that which has puzzled many scientific minds to reproduce or duplicate through any great distance.

As wireless telegraphy and telephony supplement, rather than take the place of the ordinary systems and as the transmission of power is the back-bone of commerce and industry, it seems the wires are here to stay for a long time to come. However, we must not disrespect the possibility of just as revolutionary discoveries in the future as have occurred in the past, hard as they are for us to even conceive of now. Why, even wireless telegraphy would not have approached the success it has, if the energy radiated directly by the Hertzian oscillator had been depended upon. In the first place the decrease of energy, as shown by the above law, would have been so great as to have been discouraging; and secondly, the fact that radiation travels in straight lines would have made long distance communication impossible, owing to the curvature of the earth. Both of these theories were advanced early in the development of the subject, and when approached near at hand were neither of them found as forbidding as they had seemed. It was shortly found that when the sending station was suitably grounded, that the waves actually follow the surface of the earth, and the invention of sensitive detectors made the transmission of a large amount of energy unnecessary for signaling. Many such facts about wireless telegraphy are a mystery to the average person, and although the mathematics of radiation were actually worked out over sixty years ago by James Clerk Maxwell and his co-workers, many of the exact physical actions which take place are but little understood even by the brilliant scientists of the present day. Much more is known, however, than formerly.

The wireless wave follows the earth as a huge conductor, because when the oscillations occur in the aerial, shown in Fig. 3, the lines of force moving up and down the aerial with the oscillating charge, throw off loops as shown, which are waves traveling partly *in* and partly *above* the earth. These travel off exactly like ripples on a pond, and also follow the curvature of the earth. They are much stronger than if radiated in all directions. It is evident they are not as *wireless* as they might seem, for the earth acts as a huge conductor. In early experiments between Lynn, Mass., and Schenectady, N.Y., communication was found impossible, due to the dry rock mountains intervening which acted as effective, *non-conducting* carriers. Not long afterward communication was established between Clifden, Ireland, and Buenos Aires, S.A., a distance of six thousand miles, the intervening water being a good *conducting* medium.

Wireless telegraphy and telephony are now of immeasurable commercial value, to say nothing of their importance from a purely scientific standpoint. It may even be said that we have been approaching as a limit the *wire* transmission of power for some years. In 1890 a power line was established, thirteen miles long, at Portland, Oregon, which transmitted current at 4,000 volts. In 1903, in Mexico, a line was built 104 miles long, to operate at 60,000 volts, while in 1913 the Pacific Light & Power Company of Los Angeles, Cal., began operating a line 240 miles long at 150,000 volts. This latter means a comparatively small current and a small conductor acting more and more as a guide rather than a vehicle for the power. Has a limit been reached; or will this record distance and voltage soon be eclipsed? It is a problem the engineers and scientists will try to solve in the near future.

The wireless era does not mean an era where wires are taken down and thrown on the scrap heap. We must not look for scientific miracles for nature follows natural laws. It means an age where an extra gift has been given to man, enabling him to extend his influence beyond the sphere of base matter; to annihilate distance and gain control over the finer forces of nature.

[*This is the tenth paper of a series prepared exclusively for "The Electrical Experimenter" by Mr. Rusk.—Ed.*]

BARON MÜNCHHAUSEN'S NEW SCIENTIFIC ADVENTURES.

(*Continued from page 513*)

Water on Mars is very scarce. None must ever be lost by seepage into subterranean soils, to vanish forever as far as the Martians are concerned. This has already happened on the moon, where no water is to be found along its surface except in the interior, and here most of it is ice.

By guiding the waters in waterproof canals, practically no loss is occasioned by seepage. Even where the waters are finally conducted to fertile grounds, here to grow grain, vegetables, trees, etc., they are not allowed to seep into the sub-soil. The method of doing this is as simple as it is efficient. By means of the purple disintegrating rays, the site to be used later for agricultural purposes is treated exactly as is the canal proper. This site, connected to the parent canal by narrow feeders, is as deep as the former and is, of course, waterproof. It is then filled in with fertile soil and is now ready to grow plants, trees, vegetables, etc. Thus no water is ever lost.

I must also add that when the emanation ray has transformed the bed of the new canal into its lava-like condition, this crust becomes conductive to the Martian *Ion* currents; the rest is an insulator.

I have explained to you before, that the waters in the Martian Canals are made weightless by nullifying the gravitational effect of the planet, by conducting an Ion current through the bed of the canal.

The waters, now being weightless, are easily pushed along by the rays coming from the stationary towers which line the canal, as reported some months ago.*

While this explains much of the mystery, you probably are still puzzled, as are all our scientists, why the Martian Canals are so tremendously wide. You know that several of the larger canals measuring 3,000 miles in length are from ten to twenty miles wide. Why such an extraordinary width? Would it not be better to make the canals very deep and but a few hundred feet wide, thereby saving an immense area of land, which is none too plentiful on Mars?

Again the answer is simplicity itself, although none of your scientists ever guessed it. Our host explained it to us in a few seconds. The answer to the riddle is: Evaporation.

For on Mars there are no oceans, not even lakes if you except the small circular ponds at the junction of several canals, or wherever canals cross each other.

Now then, if the canals were not so wide, the water would not evaporate fast enough into the air, here to form water vapor, the latter to be deposited finally at the two poles in form of snow and ice. The great width is absolutely necessary in order to obtain the required evaporating surface.

So nicely has all this been adjusted that by the time the canals reach their furthest North or South extensions, they carry practically no water in their shallow beds. It has been used up mainly for irrigation purposes and the balance has evaporated,

*An explanation how the Martians move the waters in their canals is found in a previous installment, published in the December, 1915, issue.

Oh, You Skinny!

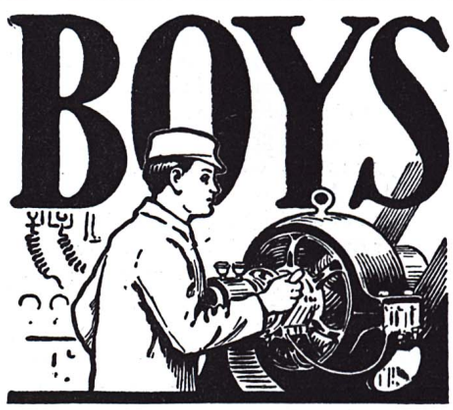
Why stay THIN as a rail? You *don't* have to! And you *don't* have to go through life with a chest that the tailor *gives* you; with arms of childish strength; with legs you can hardly stand on. And what about that *stomach* that flinches every time you try a square meal? Are you a *pill-feeder?*

Do you expect Health and Strength in tabloid form--through pills, potions and other exploited piffle?

You can't do it; it can't be done.

The only way to be well is to build up your body--all of it--through nature's methods--not by pampering the stomach. It is not *fate* that is making you a failure; it's that poor, emaciated body of yours; your half-sickness shows plain in your face, and the world loves healthy people. So be *healthy--strong--vital.* That's *living.* Don't think too long; send 4 cents in stamps to cover mailing of my book, "INTELLIGENCE IN PHYSICAL AND HEALTH CULTURE," written by the *strongest physical culture instructor in the world.*

LIONEL STRONGFORT
PHYSICAL CULTURE EXPERT
Dept. C 116 Park Bldg., Newark, N. J.



Big Money in Electricity

The electrical industries offer wonderful opportunities to boys with a liking for Electricity. The salaries paid to trained men are large, promotion comes rapidly and, best of all, the work is fascinating.

The discovery and development of new lines (such as wireless telegraphy and telephony), from time to time, promise attractive and paying fields to those who wish to specialize. The *will to do* and *Special Training* will bring success to *you.*

The International Correspondence Schools can help you to become an expert in electrical work, no matter what branch you like best. Thousands of young men have already won success through I. C. S. help. You can do as well as anybody, *if you try.* Everything is made so clear that you can learn in your spare time, regardless of where you live or what your work. No books to buy.

There's big money in Electricity. Get after it by marking and mailing the Coupon today. *Finding out costs you nothing.*

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 5325, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

☐ ELECTRICAL ENGINEER	☐ CHEMICAL ENGINEER
☐ Electrician	☐ SALESMANSHIP
☐ Electric Wiring	☐ ADVERTISING MAN
☐ Electric Lighting	☐ Window Trimmer
☐ Electric Car Running	☐ Show Card Writer
☐ Heavy Electric Traction	☐ Outdoor Sign Painter
☐ Electrical Draftsman	☐ RAILROADER
☐ Electric Machine Designer	☐ ILLUSTRATOR
☐ Telegraph Expert	☐ DESIGNER
☐ Practical Telephony	☐ BOOKKEEPER
☐ MECHANICAL ENGINEER	☐ Stenographer and Typist
☐ Mechanical Draftsman	☐ Cert. Pub. Accountant
☐ Machine Shop Practice	☐ Railway Accountant
☐ Gas Engineer	☐ Commercial Law
☐ CIVIL ENGINEER	☐ GOOD ENGLISH
☐ Surveying and Mapping	☐ Common School Subjects
☐ MINE FOREM'N OR ENG'R	☐ CIVIL SERVICE
☐ Metallurgist or Prospector	☐ Railway Mail Clerk
☐ STATIONARY ENGINEER	☐ Textile Overseer or Supt.
☐ ARCHITECT	☐ AGRICULTURE ☐ Spanish
☐ Architectural Draftsman	☐ Navigator ☐ German
☐ PLUMBING AND HEATING	☐ Poultry Raising ☐ French
☐ Sheet Metal Worker	☐ Automobiles ☐ Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____

"VIOLET RAYS"

Taking an Ozone treatment at home

Violet Rays are becoming more popular every day. The great benefits deriving from their application in common, acute and chronic diseases have increased the confidence of the professional and layman.

They are not dangerous nor do they develop habits.

They are used by thousands of doctors in their daily work. They are better than any patent medicine and represent nature's own helping hand to restore health, relieve pain, give strength. Our booklet, "The Ray of Life," gives valuable information, and is sent upon request free of charge.

WESTERN COIL CO.
180 N. Dearborn Street
CHICAGO, ILL.

Does your friend subscribe to the Electrical Experimenter?

to be re-used next season and so on.

Thus have these intelligent people wrestled with a tremendously vital problem and by their superior intelligence their water supply seems secure for thousands of years to come.

But my chronometer tells me that the recording wire of the Radiotomatic Plant on the moon is almost full to capacity. I must break off till tomorrow. Good Bye, my boy. Professor Flitternix joins me in my salute. *Au revoir* and once more good night. . .

(*To be continued*)

Electricity is now extensively used to harvest ice from rivers and ponds. The electric motors drive the ice harvesting machinery, trim the cakes and elevate them to the ice houses.

Most Sensitive Transmitter in the United States

for the Detection and Transmission of Conversation. The Holladay Detecto is *not* a new device, but has been used in official work for many years, and is well known and recommended by almost every Chief of Police in the United States. Its extreme sensitivity has been tested and endorsed by a large number of Government officials and some of the leading detectives throughout the United States; especially in New York City.
For complete information write to
HOLLADAY DETECTO CO. SUFFOLK, VA.

HOW THE WIRELESS AMATEUR FARES IN NEW ZEALAND: A RECENT COURT CASE.

Through the courtesy of one of our readers of Wellington, New Zealand, we are able to present some side-lights on the Amateur Radio operator's existence in that country, or rather his non-existence. The following brilliant excerpts from the court testimony of a recent "violation" of the Radio Act in force in New Zealand, make highly humorous reading. The maximum penalty for violating the law by erecting an experimental or *any* form of radio station is $2,500.00, sufficient to deter most anyone from experimenting with either wireless or the law. We read in "The Poverty Bay Herald" for July 4, 1916:

The hearing of the case in which Ercil Mervyn Goffe (aged sixteen years) was charged with erecting a wireless plant without the consent of the Government, was proceeded with at the Police Court on July third. Arising out of the same matter William Edward Goffe was charged that between January and June, 1916, he did aid his son in the committing of the above offense

Mr. J. R. Kirk appeared for the defendants and entered a plea of guilty.

His Worship said he should require some evidence as to what the plant was capable of doing.

Detective McLeod said the case against the boy was laid under section 164 of the Post and Telegraph Act. The facts were that the lad, who was living with his parents in upper Ormond Road, according to his own statement, started, about two years ago, to study wireless telegraphy. He erected an aerial as a preliminary, and about six months ago he completed the plant with the necessary instruments, and he commenced sending messages by dots and dashes, but could not send for more than about a mile. He also erected a small outfit in the same yard about a chain away and got a small boy to work the instrument, in order to ascertain if his machine would receive properly. No doubt his father knew the plant was there. There was a two and a half horse power benzine engine in the shed and the boy stated that he used the coils from this engine to get the motive power for the wireless, Mr. Carmine, the assistant supervisor of the local telegraph department, would explain the strength of the instrument if it was properly fitted up. When the plant was taken possession of it was dismantled.

His Worship: When was it dismantled? —Detective McLeod: On June seventeenth, and the information was laid on the twenty-third.

Mr. Kirk said he could have brought evidence to show the foolishness of this plant as a wireless plant for transmitting or receiving, but he did not deem it necessary to do so. Now it was proposed to ask Mr. Carmine, who had not seen the machine working but only after it was dismantled, to speak as to its capabilities. He had advised Mr. Goffe and the boy to plead not guilty, when they would probably have escaped punishment. However, Mr. Goffe desired to plead guilty to a technical breach. Mr. Kirk said he had an electrical expert who saw the plant working and who would say it was only a toy one.

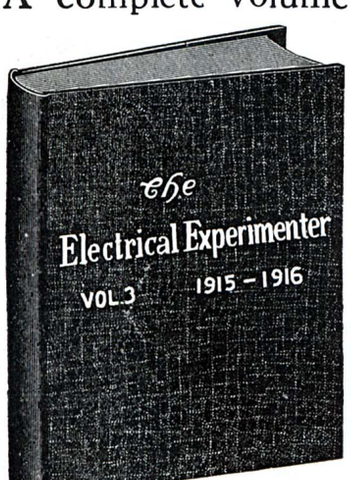
His Worship said he would give Mr. Kirk an opportunity of calling evidence.

Lewis James Carmine, assistant superintendent of the Gisborne Telegraph Department, said that in company with Detective McLeod, on June twenty-third last, he visited Mr. Goffe's residence and inspected a small engine in the shed there.

Witness was questioned as to the capacity of the engine, but said he had not seen it working.

S=T=O=P!

We hereby present the greatest bargain ever offered in electrical literature.
A complete volume of the **Electrical Experimenter** bound in rich, dark green linen, stamped with gold letters at the extraordinary low price of



$1.25

Postage on 7 lbs. is extra

Volume contains twelve numbers, 743 pages, 1,226 complete articles, 1,742 illustrations, 227 questions and answers.

A world of electrical information; the entire electrical Progress for one year; the greatest reference book on current "Wireless"—all at a price as low as the *unbound* copies would bring. Mind you, the book is durably bound with heavy covers. You will be proud to have it in your library. We have only 300 copies, therefore be sure and order to-day. Shipping weight 7 lbs. Add a sufficient amount for postage.

Order today to avoid delay

EXPERIMENTER PUBLISHING COMPANY, Inc.
Book Department, 233 Fulton Street, New York, N. Y.

Mr. Kirk objected, and also objected to the witness assuming the capacity.

Witness said the engine was sufficiently powerful to charge the accumulators used in connection with the wireless plant. He saw the room where the outfit had been and inspected the instruments.

Detective McLeod: Assuming they were properly fitted up what would you say their capacity would be?—They would be capable of transmitting wireless signals.

His Worship: For what distance?—Well, I should say they would reach any boat in the bay.

Detective McLeod: And about receiving?

Witness: With the machine properly tuned and with the crystals it would be capable of picking up messages from the Auckland and Wellington stations.

Detective McLeod: The whole of the necessary instruments are here for transmitting or receiving?—Yes, with the exception of the crystals.

(It finally developed that the Amateur never had tried out the instruments; the detector crystal having to be obtained from England.)

His Worship: The engine is not necessary for receiving, is it?—No.

So that the engine had no significance at all as far as receiving is concerned?—None whatever.

This was a low resistance telegraph, I suppose?—I am not prepared to say; I did not measure it.

Would you say it was a high resistance machine?—I would not like to say until I tried it.

Assuming it was a low resistance it would not be capable of receiving long distance signals?—No.

(His Worship evidently is NOT an electrician!!—Ed.)

His Worship: What distance do you mean?—Such as from Awanui or Auckland.

Mr. Kirk: You never saw the engine charge any accumulators?—No.

And you saw the house was fitted with electric light?—Yes.

And the engine was used for providing electricity for the house?—Yes.

Questioned as to a buzzer, witness said such an instrument was not necessary in connection with wireless telegraphy. It was used only for teaching the boys wireless signals. There was no buzzer on the plant in question.

William John Sinclair, electrical engineer, manager for Turnbull and Jones, said he had inspected the plant in question. While a good deal of ingenuity might have been used in the manufacture of the plant, witness did not think it would work at all.

His Worship: But the boy says it did, a little at any rate.

Witness: He may have thought it did, but I don't think so. Witness explained the nature of the instruments required for wireless. To send a message one hundred yards with this plant, he said, it would require an aerial four hundred feet high. The aerial in question was twenty feet high. (You don't say so?!!!—Ed.)

The Judge, good old soul, in his recapitulation, highly commended such enterprising genius in the youth of the land, but to uphold the dignity of the law fined the "lad" ten dollars and costs, and father fifty dollars and costs. And the innocent radio set that was to be, never even whimpered one single dot ten feet. Must be something like that which Senator Sorgum calls "Justice, my boy, Justice!"

And this farce comes from enlightened New Zealand!

SEARCHLIGHT ON HOTEL AN EXCELLENT ADVERTISEMENT.

For purposes of advertising and attracting the notice of automobile travelers approaching the city, the management of Hotel Bancroft, Worcester, Mass., has had mounted on the hotel roof, about 125 feet above the street level, a 24-inch searchlight of 60 amps. capacity, operated on 110 volts.

MEXICAN WIRELESS PLANT IS ENLARGED.

An addition to the wireless plant at Chapultepec, in Mexico City, giving that plant a radius of 300 kilometers, or 1,850 miles, and enabling communication between all the wireless plants of Mexico, has been completed and placed in service, according to a message received by Mexican Consul General T. R. Beltran.

Voice Thrower

Learn to throw your voice into a trunk, under the bed, out in the hall or anywhere. Lots of FUN fooling the Teacher, the Janitor, Policeman, or Friends.

The Ventrilo

is a little instrument that fits into the mouth out of sight. Boys or Girls can use it. NEVER FAILS! A 32 page book on **Ventriloquism** sent with the **VENTRILO** for **10Ct**

Royal Novelty Co.
Dept. 38 SO. NORWALK, CONN.

ACCEPT THESE BOOKS FREE

HOW TO MAKE WIRELESS SENDING APPARATUS
BY 20 RADIO EXPERTS
HOW TO MAKE WIRELESS RECEIVING APPARATUS
BY 20 RADIO CONSTRUCTORS

These two, 100 page books, each containing from 88 to 90 illustrations, are sold by us regularly at 25c. a piece.
In connection with this most remarkable offer you can now get them ABSOLUTELY FREE, for a *very limited time.*

Since we published these two books last January, over 6000 of each have been sold. If you are a wireless experimenter, yon can ill afford to be without these two latest authoritative works, published by the one concern in America, that knows what the "How-to-make-it Fiend" really wants. In these two hand books are concentrated the most important, up-to-date wireless instruments and directions how to make them. They are by far the most successful wireless books of the season. Size of each book is 5x7 inches, substantially bound on a good book paper. The covers are in two colors. We really can not praise these works too highly. You will be delighted with them.

EXPERIMENTER PUB. CO., 233 Fulton St., New York

Gentlemen:

On your absolute guarantee that your two big Wireless Handbooks are just as described by you, you may send me same *FREE*. All charges prepaid. You are to send me these books at once, and enter my name for a full year's subscription to the *Electrical Experimenter*, 12 numbers, for which I enclose *$1.50, the price of the Electrical Experimenter alone.

(If a 2-year subscription is desired, enclose $2.85.)

My name is.....

My address is.....

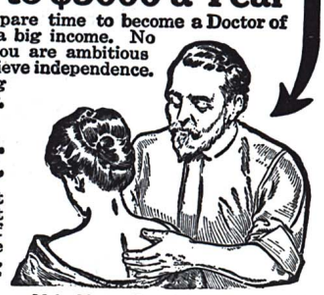
(11) *Canada and Foreign Countries, $2.00—2 years, $3.85.

Become a Doctor of Chiropractic

Learn at Home—Earn $3000 to $5000 a Year

Here is your opportunity to qualify at home in your spare time to become a Doctor of Chiropractic—to enter an uncrowded profession and make a big income. No matter where you live or what work you are now doing, if you are ambitious our Course in Chiropractic shows you how easy you can achieve independence. Some of our men and women graduates are actually making upwards of $10,000 a year in the practice of this fascinating, profitable profession of Drugless Healing—the Science of

Spinal Adjustment



Never before has the demand been so great for competent Doctors of Chiropractic. Every thinking person knows that the day of Drugless Healing is here, and that the masses of people everywhere are eagerly welcoming Chiropractic, the science of restoring health by means of spinal adjustment, as a natural, scientific substitute for the old outgrown system of "dosing" by internal medicines.

Make Money Practicing Chiropractic, the Science of Spinal Adjustment.

20 Lessons Free to Convince You

To show you quickly and convincingly what Chiropractic is, we offer you 20 Lessons of our Regular Course absolutely Free—also our big 64-Page Book and Eight (8) Anatomical Charts beautifully lithographed in lifelike colors that regularly sell for $15.00.

You can become a Doctor of Chiropractic in a surprisingly short time by our practical, easy simplified method of home instruction. All needless theory is thrown aside—our course offers the shortest, most direct route to your degree of D. C.—Doctor of Chiropractic. We give you, right in your own home during your spare time, just the training you must have to succeed.

NOW! Send for Our Big Wonderful Offer

$250 to $500 a Month for You

That's what you can earn as an Expert Doctor of Chiropractic. Special reduced rates now! Mail Coupon or write today—Sure!

AMERICAN UNIVERSITY,
Dept 679 Manierre Building, Chicago, Ill.

Free Lessons Coupon
AMERICAN UNIVERSITY,
Dept. 679 Manierre Building, Chicago

Without cost or obligation send me by mail, prepaid, your new illustrated 64-page Book and your remarkable Free Lessons Offer, etc.

Name.....

Address.....

ACCEPT THIS BOOK FREE

IT'S INVALUABLE YET CAN'T BE BOUGHT

Just as you will receive it, cloth bound, size 7 x 10 ins., 160 pages, 20 lessons, 350 illus., 30 tables, with every bit of information on Wireless you can possibly want, besides valuable information on Electricity, Magnetism and Theory of them **—and it's FREE as explained.**

Will you take a 20 lesson Wireless Course absolutely FREE—even postage charges prepaid?

A course that tells you everything you can possibly want to know about "Wireless" starting off in lesson No. 1 by explaining the Principles of Electricity. The second and Third Lessons are devoted to magnetism, motors, generators and wiring. And then, by simple, easy stages this wonderful Course takes you into "Wireless." The mysteries of "Wireless" are unfolded to you by the use of such simple language so skillfully used, that of necessity you must understand every word. The subject is not treated superficially, however, for there is a whole lesson devoted to the Theory and Mathematics of this epoch marking subject To lend charm to the Course, the last Lesson (No. 20) is devoted to a history of Wireless and the men who developed it. The wireless course positively cannot be bought, but will be sent absolutely free with a full year's subscription (12 numbers) to the Electrical Experimenter at $1.50. It's the biggest money's worth you can ever buy anywhere at any time. Send for it today enclosing $1.50. Send **now** before you forget.

The coupon below is a convenient way. But do it now.

THE EXPERIMENTER PUB. CO., Inc.
Publisher
"The Electrical Experimenter Magazine."

EXPERIMENTER PUB. CO., 233 Fulton St., New York

Gentlemen:

On your absolute guarantee that your 20 Lesson Wireless Course is just as described by you, you may send me same *FREE*. You are to send me this Course at once, all charges paid, and enter my name for a full year's subscription to the *Electrical Experimenter*, 12 numbers, for which I enclose *$1.50, the price of the Electrical Experimenter alone.

(If a 2-year subscription is desired, enclose $2.85.)

My name is.....

My address is.....

(11) *Canada and Foreign Countries, $2.00—2 years, $3.85.

EXPERIMENTAL ELECTRICITY COURSE IN 20 LESSONS

By S. GERNSBACK and H. W. SECOR

¶ A new course of the theory and practice of electricity for the experimenter.

This is undoubtedly one of the most complete and comprehensive treatises on this special subject ever published.

The book is written by the same authors as the now famous "Wireless Course in 20 Lessons."

Every phase of experimental electricity is treated comprehensively in plain English. It is a book not only for the beginner, but for every experimenter and student of electricity.

All the knowledge of the authors has been devoted to making the study of electricity simple to the layman.

New Experiments are described and explained and nearly every application of electricity in modern life is given in simple language.

It is the most complete and practical course ever published, not only useful, but absolutely necessary to everybody interested in electricity.

The book contains 160 pages, more than 400 illustrations.

Cloth Bound (Special thin paper edition) **Price, $1.00**

DELIVERIES ARE NOW BEING MADE

HOUSEHOLD USES OF ELECTRICITY.

Furnish illumination for the house.
Heat water for shaving, or the bath.
Percolate the breakfast coffee.
Toast bread.
Fry eggs or anything that will fry.
Poach eggs, cook the cereal, or heat milk.
Operate the washing machine and clothes wringer.
Iron the clothes.
Run the vacuum cleaner.
Operate the sewing machine.
Cool rooms with an electric fan.
Knead the dough and bake the bread.
Grind, mix, churn, whip cream, make ice cream, polish silver, etc.
Heat a fireless cooker.
Make the tea in a samovar.
Cook food in a chafing dish.
Ignite cigars.
Keep hot the heating pad (used in place of hot water bottle).
Warm the milk for baby day or night.
Pop corn.
Protect houses from burglars.
Amuse the children by running electric toys.
Give electric baths in bath cabinets.
Carry the family in the electric automobile.
Purify the drinking water.
Polish the floors (electric floor polisher).
Dry the washing (electric drier).
Sterilize water or utensils.
Make ice—furnish refrigeration.
Play the piano.
Mix family beverages.
Lift or lower dumb waiters.
Energize doorbells and annunciators.
Curl a woman's hair.
Dry a woman's hair.
AND run your wireless.

WITH THE "AD-MAN"

Along about this time people commence to count up their loose change, and sharpen their pencils to make up their Christmas gift list and in general think of the approaching holidays.

And right here is where I'm going to ask you when making up your list that you consider how many of your gifts can be purchased from advertisers in THE ELECTRICAL EXPERIMENTER.

Wireless Apparatus of all kinds of course, watches, books, sporting goods, electrical apparatus, toys, hearing devices and many, many other things.

But there's one gift I'll bet you never thought of for a good friend or brother, one he will always bless you for. It's a correspondence or resident course in some subject he's anxious to learn. Yes, the course may cost more than you can afford, but at least you can make the first payment for him. Chances are you start him off like that and you will in later years have the pleasure of knowing that you were responsible for the rise in the world of one person.

Is there any greater satisfaction in giving than that?

By the way, if there is any information you want on any of the courses that are advertised in THE ELECTRICAL EXPERIMENTER or those that are not, just ask me and I'll be glad to offer all the information I have available.

Try me and see.

MILTON HYMES.

Scientific Exchange Columns

UNDOUBTEDLY you have at the present time some things for which you have no further use. Do you wish to exchange them for something, for which you have immediate use? There is no surer and quicker way to do this than by advertising your articles in these columns. The *Very* people, the *Only* people, who could possibly have a use for your things read this journal. More than 70,000 interested people will see your ad. It is furthermore the cheapest advertising medium for you in the country. Dealers' advertising accepted in Opportunity Exchange Columns only.

The rates are: *Three cents per word* (name and address to be counted), minimum space 3 lines. Count about 7 words to the line. *Remittance must accompany all orders.* No advertisement for less than 50c. accepted.

We reserve to ourselves the right to refuse any advertisement which we consider misleading or objectionable. Advertisements for the December issue should reach us not later than October 25th.

The Classified Columns of "The Electrical Experimenter" Bring Positive Results.

Subscribers experiencing trouble in dealing with any advertiser should notify the publisher very promptly.

OVER 70,000 PEOPLE READ THIS JOURNAL

SALE OR EXCHANGE—Camera and outfit. Cost $40.00. Send for particulars and list of Radio apparatus. Want sending transformer or what have you? Richard Anderson, North Wildwood, N.J.

BARGAIN—Three 110-volt electric stoves, 65c. each. One electric iron, $1.25. One $2.00 camera, 75c. All goods guaranteed. Prepaid. Richard Gaillard, Pendleton St., Columbia, S.C.

WILL TRADE new Tel-Radion for 43-plate variable, 1,200 meter loose coupler and ¼-inch spark coil for navy type loose coupler. Want ½ K.W. Coil, Audion, Holtzer Cabot phones, variables and other wireless goods. R. A. Ruble, Centralia, Wash.

THREE Audiotron Bulbs, never used, $5.00 each. Postpaid, Electro-selective Coupler, $5.00. Trade for Coupler, Polar relay or Meters. R. G. Anderson, 7211 Indiana Ave., Cleveland, Ohio.

FOR SALE—New Blitzen Variable Condenser, $2.50. Blitzen fixed condenser, 75c. Crystaloi Detector Type AA, $2.50; with Buzzer and Testing Coil, $3.25. Murdock Tuning Coil, $1.50. 1¼-inch Bull Dog Spark Coil, $3.00. Spark Gap, 50c. Everything new, no trade. Richard Taylor, 141 Lake St., Winsted, Conn.

WANTED—Typewriter. Have 24 things in exchange. Send for list. A. Hofman, 382 Cornelia St., Brooklyn, N.Y.

WANTED—AN independent interrupter to be used on a 14-inch Spark Coil. Will buy for cash or trade. R. W. Gates, 826 First Place, Plainfield, N.J.

FOR SALE—Small sending and receiving set. No phones. Cheap. Write for particulars. Elmer Raguse, Tottenville, Staten Island, N.Y.

FOR SALE OR TRADE—Vest Pocket Kodak with leather case, $4.50. Remington Single Shot Rifle, $2.50. Flashlight, 2 extra Batteries, 85c. Premo Camera No. 0, $1.00. Want receiving apparatus. George Coxe, Olean, N.Y.

SPECIAL BARGAINS—Large 115 volt D.C. Fan Motor for $8.00; Sensitive relay, $2.50; new .25 calibre rifle for $4.00; Cover of $5.00 foot-ball for $1.75; Electric whistle, 50c.; Telegraph sounder on marble, $1.00; Telephone receivers and transmitters each 75c.; Magnetos, $2.00 each; 2,000 ohm ringer for $1.00; non-breakable potentiometer, 75c. All in A1 condition. Write for particulars. Clarence Kositzky, 911 South Ninth St., Lincoln, Neb.

FOR SALE—Knapp dynamo-motor, $3.00; tuning coil, $1.25; telephone magneto, $2.00. Trade for good double headset or variables. Raymond Gerich, Rich Hill, Mo.

FOR SALE—9 volt 15 amp. generator, $10.00; ¾-inch spark coil, $2.50. Paul Watson, 214 West Barnard, West Chester, Pa.

FOR SALE OR TRADE—Never been used, $7.25 receiving transformer, 3,000 meter, $6.00; $3.50 Turney variable condenser, 35 plate, $3.00; 70c. fixed condenser, 50c. I want Corona typewriter, Audion detector, Audiotron bulb, aerial material or what have you? George Dimon, 367 Genesee St., Utica, N.Y.

TO SWAP—Old gun valuable as relic, shot gun and rifle, also books for wireless apparatus. Write. Robert Holverson, Kasota, Minn.

MAGAZINE WANTED — Will pay cash for any back numbers or bound volumes of Aero, Aeronautics, Aircraft, Flying, Electrical Experimenter and Wireless Age. State price. L. Koerner, 312 W. St. Vrain St., Colorado Springs, Colo.

FOR SALE—Rotary spark gap, never used, operates on 6 volts. F. C. Cave, Winfield, Kan.

WHAT am I offered for a 3 H.P. Reading Standard, single cylinder, motorcycle engine? Will take wireless instruments, cash or both. Send stamp. R. B. Wailes, 3118 14th St. N.W., Washington, D.C.

FOUR SALES—¼-inch spark coils, perfect condition, giving large spark, 65c. each. Adrian Kishpaugh, Newton, N.J.

FOR SALE or EXCHANGE—2,000 Stamp Collection of rare varieties in good condition; want wireless goods. Albert Hjorth, Port Jervis, N.Y.

SALE OR EXCHANGE—My new 1/6 K.W. Wireless Transformer, New Coherer, 1 K.W. Aerial Switch. Will give 1/6 K.W. for audion bulb. All letters answered. Jeter Pinkston, Valdosta, Ga.

MOTORCYCLE WANTED—Will give $75.00 Receiving Set, $25.00 worth of other electrical apparatus and money. Write for proposition. Van Pattillo, Hartselle, Ala.

LOOK!—25 Steven's rifle and jointed cleaning rod, good as new, $5.50. Also Shaw's smoker used twice, $2.50. Express prepaid. Ingman Ostrem, Perley, Minn.

23 GLASS PLATE sending condenser, $2.00; helix, $1.00, new and never used; fine 75-foot aerial, 30c.; brand new pony receiver, 25c.; complete Hustler Motor, 25c. Rolston Bear, Hemet, Cal.

WANTED—A good headset in exchange for a Victor Phonograph, also camera and outfit, acetylene generator, two tennis racquets, ice and roller skates, and postcard projector. Want wireless apparatus or cash. Write. Roger Hackney, Wellington, Kan.

WILL SELL OR EXCHANGE for high-grade, postcard size, folding camera; one $8.00 2-inch coil, one $3.00 Murdock 7-plate Variable Condenser. Terms strictly C.O.D. express, $7.00, no installment plan paying. Robert Haag, Chadwick, Ill.

FOR SALE—Will sell my brand new Electro Loose Coupler and Loading Coil for $7.00. Both are new this summer and in A1 condition. Write. Stanley Batchelder, 82 Willard Ave., Portsmouth, N.H.

WILL EXCHANGE $11.00 Omnigraph for Brandes Transatlantic or other 3,000 ohm phones. Must know make beforehand. J. Chaffee, Woodmont, Conn.

$275.00 SLABY-ARCO open core 3 K.W. Transformer, $45.00; 1 K.W. Transformer, $5.00; 10-inch Rotary Gap Wheel for sets up to 3 K.W., $5.00, never been used; Panel and Coils wound and tapped for cabinet set, $10.00. Will make good trade for De Forest Ultraudion or tubular bulbs. Wm. Trumbull, 365 McGraw Street, Seattle, Wash.

FOR SALE OR TRADE—$35.00 Shell Lake Canoe in A1 condition, used three months, for Thordarson or Packard 1 K.W. Transformer or anything you have. All letters answered. Frank Gerster, Havana, Ill.

BUGS!—Big Bargain if you buy my complete sending and receiving Outfit, aerial included, cost $30.00, sell for $20.00. Write for particulars. Fay Williams, Huron, Ind.

SACRIFICE—First $20.00 gets two audions and board; two variable condensers; one fixed condenser; one tuning coil; one potentiometer, also one combination galena silicon carborundum etc. detector. All guaranteed in excellent condition. Write for particulars. R. W. Hoffman, 4011 Greer Ave., St. Louis, Mo.

$15.00 LOOSE COUPLER, $5.00; $7.00 Clapp-Eastham Ferron Detector, $2.50; Omnigraph, 75c.; D.P.D.T. Switch, 75c.; Buzzer; Push Binding Posts; Mineral; etc. FIRST Money order for $10.00 gets everything. Robert Boehner, Brookline, Mass.

FOR SALE—$12.00 1 K.W. rotary, cost $17.50; $7.00 ½ K.W. antenna switch, cost $3.00. Write for particulars. J. S. McDonnell, Jr., 3304 Eighth Ave., Little Rock, Ark.

WANT racing bicycle attachment motorcycle engine. Have athletic and wireless goods. Laurenz, 405 Fulton, Canton, Ohio.

SALE OR EXCHANGE—Two complete sending and receiving outfits. All kinds of Electrical Apparatus sacrificed. Want audion or bulb; switches; storages, etc. Write; all with stamp answered. Frederick McMullen, Fairchance, Pa.

SALE OR EXCHANGE—Camera, Kodaks, Minute Machine; Phonograph, Musical Instruments. Write. S. Copeland, Ahoskie, N.C.

OSCILLATORY SET—3 inductances, 4 variables (Murdock's, Blitzen, Amco), Radio (Pottstown) coupler, $20.00. 3,500 mile range. J. McKenna, Shonnard Terrace, Yonkers, N.Y.

EXCHANGE—E-flat Clarinet and Navy loose coupler for 1 K.W. transformer, either open or closed core. Both articles perfect condition. A. Ericson, 19 Bartlett St., Beverly, Mass.

SALE OR EXCHANGE—Edison Standard Phonograph; 50 4-minute, 15 2-minute records. Good condition. Cost $60. Would like audion detector or amplifier. George Perkins, 365 Union St., Jersey City, N.J.

FOR SALE—Two-inch spark coil, $5.00. Claudius Burt, 102 Argyle Road, Ardmore, Pa.

WILL SELL $30.00 Receiving Set for $20.00. Range 1,500 miles on suitable aerial. Write. Leroy Martine, North Bergen, N.J.

HAVE—1 K.W. Sending Condenser, $8.00; 2 K.W. oscillation transformer, $8.00; marble switchboard with switches; electrical books; ¼ H.P. Ft. Wayne 60-cycle motor; Roth rotary converter, etc., for sale or exchange for No. 3-a loose coupler or magnet wire. Write for descriptions. Ralph Batcher, 131 Hyland, Ames, Iowa.

COMPLETE chemical outfit, High-grade C.P. chemicals. My large laboratory for sale at a bargain. Ralph Batcher, Toledo, Iowa.

FOR SALE—Wireless set, whole or parts. Send for particulars. Frank Plaisted, 142 Davis Ave., Brookline, Mass.

FOR SALE—Chambers 748 Loose Coupler in perfect condition. First check for $5.00 takes it. All other checks positively returned. Dean Carpentor, Westtown, Pa.

WILL EXCHANGE—One $2.50 Perikon detector and foot-ball for one new Murdock Loading Inductance. Stuart Terrill, Brookfield Center, Conn.

FOR SALE—Two complete receiving sets, $11.00 and $22. Write. Cromer Heitslin, Kissel Hill, Pa.

RECEIVER for spark or arc stations consisting of: $18.00 Chamber's coupler; double filament audion cabinet complete; 2,000 ohm phones, two months old, perfect condition. Also two military type portable telephones with buzzer attachment, good condition. What offers or exchanges? W. A. Brooke, 3127 North 13th St., Philadelphia.

FOR SALE—Receeiving Set, complete, with aerial and parts. Price $10.00. Schorr, 330 Essex St., Brooklyn, N.Y.

FOR SALE OR EXCHANGE—"Electro" High Tension Adjustable Condenser; "Electro" rotary Potentiometer; Radioson Detector with used cartridge; "Electro" Helix with pilot lamp. Want "Gernsback" or good 43-plate Variable. Cash for Variable. Louis Menier, 443 E. 85th St., New York City.

WANTED—¼ K.W. Packard transformer in perfect condition. State price. All letters answered. John Q. Adams, 5424 Fulton St., Chicago, Ill.

FOR SALE—Electric Therapeutic Apparatus or willing to exchange for a high frequency apparatus for a very reasonable difference. Kindly call at 364 West 67th St. or 113 West 63d St. on Sunday. John Ferguson.

FOR SALE—5-inch Induction Coil in fine condition, $20.00; new 6-80 storage battery, $10.00; 1/10 H.P. compound wound 110 V. D.C. motor, $6.00. Want 3A Kodak or Graflex Camera. W. S. Wells, 6626 S. Marshfield Ave., Chicago, Ill.

FOR SALE—Mignon RLC6 receiving cabinet, practically new, cost $75.00. My price $60.00. RJ9 Audion detector, never been used, $12.50. R. M. Richert, Statesville, N.C.

EXPERIMENTER—Until November fifth, $17.00 buys $27.00 complete receiving set consisting of Lightning Switch, Antenna Switch, Murdock 2,000 ohm headset, Arlington Loose Coupler, Turret Cup Detector with crystal, Precision loading coil, fixed condenser, fixed variable condenser and rotary variable. Each piece reliable. G. R. Campbell, 207 Grant Ave., Bellevue, Pa.

SALE OR EXCHANGE—Dynamo, ¼-inch coil, medical coil, magic lantern, Pony receivers, books, small phonograph. Want: 110 V. motor, Victrola, storage battery, tools, wireless sundries, etc. What have you in any line? Send stamp. Orville Huish, 140 Byron, Youngstown, Ohio.

WILL TRADE—Electric postcard projector with 110 V. bulb for ½-inch spark coil. Marion Miller, La Harpe, Kan.

BARGAINS—Instruments are practically new. Loose coupler, $5.00. Double slide tuner, $1.25. Detector, 75c. Money back if dissatisfied. G. M. Lesher, East Orange, N.J.

WILL EXCHANGE for wireless goods, a complete course of 20 lessons in Hypnotism with other scientific matter. A. Bozinsky, 339 E. 47th St., New York City.

FOR SALE—Brandes Superior single headset, $2.00; Amco ¼ K.W. closed core with primary variation, used one month, $10.00; small coupler, $1.00. Lee Hodges, 3408 Duvall Ave., Baltimore, Md.

GENERATOR C.P. 32 V. 20a direct connected to 2 H.P. Motorcycle Engine for good collection of U.S. and Foreign Postage Stamps. Petticrew, 133 Gunchel Ave., Dayton, Ohio.

WANTED—Best sending set for $10.00. Give description, range, amount used. Wm. M. Crane, Richmond, Mass.

AUDION AMPLIFIER—Good bulb, used 3 hours, cost $65.00. Sell for $35.00. Browne, 384 Mott Ave., New York City.

COMPLETE sending and receiving station, cost $52.45, practically as good as new; will sell for $35. Send for description. J. E. Matson, Neola, Iowa.

EXCHANGE—New "Electro" Transcontinental Outfit No. 1603. Want good typewriter. Forrest Elwell, De Veaux College, Niagara Falls, N.Y.

FOR EXCHANGE—Combination Edison fireside phonograph (new) and 45 four-minute records, value $35.00, for complete receiving set of equal value. P. B. Smith, 298 Bond St., Bridgeport, Conn.

WILL EXCHANGE—A complete "Telegraphone" talking and reproducing head for use in recording radio messages on a moving steel wire or band. Also a finely calibrated Keystone milliampere meter excellent for radio measurements. Will exchange the above for any of the following: A.C. or D.C. volt or ammeter, preferably of the Keystone or Weston make; small A.C. motor, ¼ K.W. transformer, or what have you? Samuel Cohen, 1936 Pitkin Ave., Brooklyn, N.Y.

RADIOSON DETECTOR, new, for sale. See description in Electro Importing Co.'s catalog. First money order for $2.75 takes it. Edward Jones, 522 Fairmont Ave., Fairmont, W.Va.

WILL EXCHANGE—New 6 volt 180 ampere Willard Storage Battery for De Forest Audion Detector, and Amplifier or Two Step Multi-Audi-Fone; must be in good condition. Have Type O Crystaloi Detector and Resonator, used two months, $2.00; Manhattan adjustable primary condenser, used two months, $3.00. What have you? Bruno J. Warsh, 718 W. 19 Place, Chicago, Ill.

FOR SALE—Ive's Electric train, $4.50; 40 watt Dynamo Motor, $4.50 (new), Baldwin Camp Lamp, $1.50, Steam Engine, $1.50. Might trade. William Van Akin, Liverpool, N.Y.

FOR SALE—Oliver No. 3 Typewriter, almost new, $23.00. Also have camera, photo, tent, rifle and watch at bargain prices. Joseph O. Berg, Hendrum, Minn.

FOR SALE OR EXCHANGE—International Correspondence School's course in arithmetic, also electrical books and apparatus, cheap. Alex. Serna, Lehigh, Okla.

FOR SALE—A first class Wireless Sending and Receiving Outfit. Two sending outfits, Erector set No. 4 and a Microscope Outfit. Make offer. Enclose 2c. stamp. John Houhy, Mattapan, Mass.

COMPLETE Wireless receiving outfit loose coupler; condenser; 2,000 ohm phones; loading coil; telegraph key and sounder, all for $7.00. Shartle, 575 West 172d St., New York City.

FOR SALE—Or will trade a 15 K.W. high voltage transformer with rheostat and switch board for a Hytone transmitting set. Write. Harry Cole, 1515 Linwood Blvd., Oklahoma City, Okla.

FOR SALE—Complete Wireless Outfit; ¾ K.W. Transformer, Clapp-Eastham Receiving Cabinet, 3,000 Ohm Phones. Cost over $75.00. Will sell for $45.00. Send for particulars. Harry Anders, Decatur, Mich.

FOR SALE OR EXCHANGE—Two absolutely brand new Electron Relay Bulbs, positively never used, each $3.25; 4 Bar Telephone Magneto and Case, $3.50; ¼ K.W. Gap, 40c.; Tillotson Telegraph Sounder, $2.00; Variometer (Home made), $1.24; E. I. Co. Fixed Condenser, 50c.; Rotary Gap Disk, $1.35; Helix (Home made), 12x12 inches, $1.50; two 60A600V SPDT slate base fuseless switches, each $1.00. All except switches prepaid. L. B. Stratton, Oneida, N.Y.

WILL TRADE—Smith Motor Wheel in good condition for ½ K.W. Sending Set, complete, with rotary gap. Vernon Wise, Butler, Pa.

FOR SALE—15,000 meter tuner, $10.00; telegraph set, $1.50. Other apparatus. Edward Silver, 264 West 57th St., New York.

MUST SELL—New Crystaloi detector type A, $1.75; E. I. Company Transatlantic 1,000 ohm phone and cord, $1.50; new 6 volt 60 ampere Willard Storage Battery, automobile, type, used two months, $9.80, cost $17.50; 1½-inch box type spark coil $5.60, cost $8.00; Hydrometer, 65c.; 6 volt 4 ampere Knapp dynamo motor, $2.90; Switchboard, 2 double pole switches, 2 single pole hard rubber switches, rheostat, ammeter. All very neatly mounted on stained wood base, $4.80; double pole double throw 30 ampere antenna switch, 90c.; electric thriller magneto shocking machine, 50c. All articles have been used only a very short time, have been well taken care of and are as good as new. Special $2.85 foot-ball without bladder, $1.45, used once, guaranteed good as new; Stevens .22 target rifle, $2.40, cost $4.75, used very little. Roy Sprecher, Lancaster No. 5, Pa.

Opportunity Exchange

YOU will probably find more opportunities and real bargains in these columns than anywhere else in the country. Most good things in life are hard to find and worth going after—these little ads illustrate that point; you alone will be the real loser if you don't take the time to scan through these columns.

Advertisements in this section 4c. a word for each insertion. Count 7 words per line.

Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency.

Ten per cent. discount for 6 issues, 20 per cent. discount for 12 issues from above rate. Objectionable or misleading advertisements not accepted.

Advertisements for the December issue should reach us not later than October 25th.

OVER 70,000 PEOPLE READ THIS JOURNAL

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N.Y.

BOOKS

HAVE YOU SEEN A COPY?—Amateur Photographer's Weekly, $1.50 per year; weekly prize competitions; criticisms; print exchange; illustrated; many features. Three months' subscription 40c. Amateur Photographer's Weekly, 915 Schofield Bldg., Cleveland, Ohio.

BOOKS—Scientific and wireless supplied. Let us know what you want and we will quote you. Experimenter Pub. Co., 233 Fulton St., New York City.

A BINDER for THE ELECTRICAL EXPERIMENTER will preserve your copies for all time. Price 50c. Postage on 3 lbs. is extra. Send for one to-day. Experimenter Pub. Co., 233 Fulton St., New York City.

MISCELLANEOUS

FORMULAS—60 GUARANTEED MONEY-MAKERS, 10c. Catalog for stamp. "IDEAL," (EE) Irving Station, Chicago.

STAMPS—75, all different, free. Postage 2c. Mention paper. Quaker Stamp Co., Toledo, Ohio.

MAGIC GOODS—TRICKS—PUZZLES. Big catalog free. C. Hagen, 2423 Winnemac Ave., Chicago.

TRICKS — PUZZLES — MAGIC GOODS — GAMES—NOVELTIES. Sample and catalog 3c. Ideal Magic Shop, (EE) Irving Station, Chicago.

PATENT ATTORNEYS

AMERICAN AND FOREIGN PATENTS obtained. Before selecting an attorney, write for our solid, instructive advice; join the ranks of happy inventors. Correspondence Office, 125 East 23rd Street, New York City. F. V. Winters, Reg. Patent Lawyer. New York City and Washington, D.C.

PATENTS SECURED OR FEE RETURNED—Send sketch or model for free search and report. Latest complete patent book free. George P. Kimmel, 254 Barrister Bldg., Washington, D.C.

IDEAS WANTED—MANUFACTURERS are writing for patents procured through me. Three books with lists of hundreds of inventions wanted sent free. I help you market your invention. Advice free. R. B. Owen, 130 Owen Bldg., Washington, D.C.

PATENTS BRING RICHES—Protect Your Invention. Attorney's fee payable when patent allowed. Plain advice and "Patent Facts" free. Trademarks registered. Jaynes & Jaynes, 501 Kellogg, Washington, D.C.

PATENTS—Personal attention to all inquiries. No printed literature. No lists of "Inventions Wanted"—such being unauthorized by the Patent Office. Fees reasonable, consistent with best results obtainable. Electrical and Mechanical Expert. J. Edwards Bangs, Suite 408 Barrister Bldg., Washington, D.C.

PHOTOGRAPHY

FILMS DEVELOPED FREE—Send negative for sample print and particulars. New Lex Novelty Co., New Lexington, Ohio.

MARCONI—We have a limited supply of pictures of Guiglielmo Marconi that are done in sepia on fine India paper. Fine for decorating your wireless room. Ten cents each postpaid. Experimenter Publishing Co., 233 Fulton Street, New York.

PHOTOGRAPHY WITHOUT CAMERA—Novel social pastime, using photo paper invisibly prepared with interesting and artistic pictures. Samples prepared for 25 pictures with directions, 10c. Wedge Mfg. Company, "Km," Binghamton, N.Y.

WIRELESS

DOUBLE filament audiotron bulbs, $4.50 each. Full directions for making a Wireless Telephone given with each bulb. Leon Bartholomew, 313 Deyo St., Jackson, Mich.

STRANDED TUNER WIRE for receiving ARC and LONG DISTANCE—10 copper enamel wires covered with silk at 1c. per yard, 20 wires 2c., state whether No. 36 or No. 38 enamel wire is desired; discount on ½ and 1 pound lots. Special sizes to order. J. H. Claus, Hulmeville, Pa.

RADIO QUESTIONS answered, 3 for 10c.; 9 for 25c. Cat wiskers, 4 for 7c. Walter Patch, Ventura, Iowa.

TELEGRAPH—Morse and Wireless, also Station Agency taught. Graduates assisted. Cheap expense, easily learned. Largest school, established 42 years. Correspondence courses also. Catalog free. Dodge's Institute, Lone St., Valparaiso, Ind.

UNUSUAL BARGAIN—Rotary Converter operating on 110 volts D.C. and having an output of 85 volts, 11 amperes, at 60 cycles. Operates ½ K.W. transformer perfectly. Is unusually small; size 8½x9x11 inches; weight 64 lbs. Has regulating rheostat 12x13x6 inches weighing 29 lbs. and is an ideal equipment for experimental purposes. Price complete $35.00. Electro Importing, 236 Fulton St., New York City.

NAVY TYPE COUPLER and loading coil combined, $12.00; 2,500 meter coupler, $5.00; other bargains. Cliff Mfg. Co., Brookfield, Mass.

MOTORS—Rebuilt at extra low prices. 1/6 H.P. 110 V. D.C., $6.00; 40 Watt, $4.00. A. J. Temps, 1690 Grove St., Brooklyn, N.Y.

MURDOCK No. 55

Wireless 'phones of *proved* sensitiveness, distinctive appearance, and excellent construction. *The best value in the world.*

They possess *every* desirable quality necessary to class them with the best 'phones on the market.

2000 OHM COMPLETE DOUBLE SET $4.00

3000 OHM COMPLETE DOUBLE SET $5.00

EQUAL IN EVERYTHING BUT PRICE

To 'phones of *double* the cost. BUY A PAIR with the clear understanding that if they are not *what you want*, you may send 'em back and get your money at once. Examine them carefully. Note the standard double poles with pure copper wire windings. See the flexible, properly-seated diaphragm. Observe the excellent quality of headband and cord. Appreciate the beauty and workmanlike appearance of the assembled set. THEN—TRY THEM OUT with your set. Note the distinct, readable tone. Observe their remarkable sensitiveness and the surprising volume of response to weak signals. Compare them directly to any 'phones you may select, and if, after

FOURTEEN DAYS' TRIAL

you determine that they are not the best 'phones in the world at such low prices, send 'em back, and get your money. MURDOCK RECEIVERS are sold with an absolute guarantee of complete satisfaction or money back. Be assured that an investment of four or five dollars in a set of No. 55 'phones will purchase as good a set of wireless receivers as you will ever require. ORDER A SET TODAY.

A complete line of moderately priced, really good MURDOCK APPARATUS is shown in our 48-page Catalog No. 15. Send for your copy. It is FREE.

WM. J. MURDOCK CO.

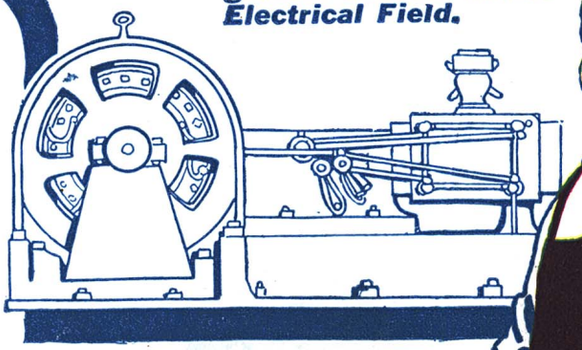
55 Carter Street, Chelsea, Mass.

221 Second Street **San Francisco**

Succeed Through Electricity

This interesting story shows you the way to greater success in the Electrical Field.

This is the Electrical age. Electricity now controls more trades, directs more men, offers more opportunities than any other power that man has yet discovered. Through *exact* knowledge of Electricity you will advance in salary and position.



Hawkins Electrical Guides Will Show You How

These books are the standard works on Electrical Science. They are a complete and up-to-date course in Electrical Engineering, presenting the information in a way you can use it. Only $1.00 per volume and owners of the set say there are no better electrical books published at **any** price.

Specially Arranged for Home Study and Reference They fit your pocket and your pocket book. Beautifully bound in **flexible** black leather with gold edges. Easy to read and handle. You can carry each single volume about with you until you have mastered the subject it contains. Written in the form of questions **you** would ask and the answers to them — in plain, practical, everyday language, complete, concise, authentic and to the point. Over 3200 pages and more than 4,000 illustrations.

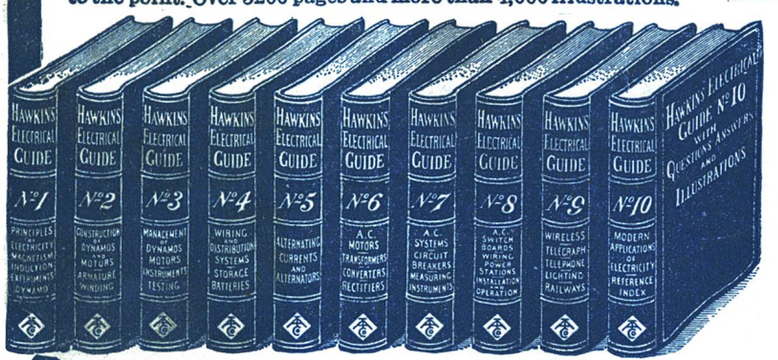
Read These Testimonials

"Any Electrician, Operating Engineer, or Student who wants to do his own construction or further advance himself in the Electrical field should have a set of these books."
JOHN KELLEY
116 Union St., Newark, O.

"For the man not getting a college training and even in that case, I can sincerely say I do not believe there is a better set of books in the market today."
LLOYD D. HUFFMAN
Dayton, O.

"We consider Hawkins Electrical Guides the most compact and complete set of electrical references in the market."
NOGGLE ELECTRIC WORKS
Monterey, Cal.

"Hawkins surely knows the art of condensing information."
ELBRIDGE F. BALL
Buckland, Conn.



10 NUMBERS IN ALL

1.00 A Number PAYABLE 1.00 A Month

Shipped to You FREE

YOUR FREE COUPON

Theo. Audel & Co.
72 Fifth Avenue, N.Y.

Please send me for FREE examination Hawkins Electrical Guides (Price $1.00 each). Ship at once prepaid the TEN numbers. If satisfactory I agree to send you $1.00 each month until paid.

Signature .....
Occupation .....
Business Address .....
Residence .....
Reference ..... Nov. E.E.

Send no money. Examine the books first. Decide for yourself that they are the most complete library of Electricity ever published and that you cannot afford to be without them. Every book is complete in itself, but the complete set is the best bargain. The last volumes are just coming off the press. **Eight numbers now ready.** Accept this unusual offer now—to-day. Each page—every illustration will convince you of the big value we are offering. See the books first, then decide. If you decide to keep them you can make settlement at only $1.00 monthly until paid for.

EASY PAYMENTS

Theo. Audel & Co.
72 Fifth Avenue
NEW YORK

A FEW OF THE SUBJECTS

Magnetism—Induction—Experiments—Dynamos—Electric Machinery—Motors—Armatures—Armature Windings—Installing of Dynamos—Electrical Instrument Testing—Practical Management of Dynamos and Motors—Distribution Systems—Wiring—Wiring Diagrams—Sign Flashers—Storage Batteries—Principles of Alternating Currents and Alternators—Alternating Current Motors—Transformers—Converters—Rectifiers—Alternating Current Systems—Circuit Breakers—Measuring Instruments—Switch Boards—Wiring—Power Stations—Installing—Telephone—Telegraph—Wireless—Bells—Lighting—Railways. Also many Modern Practical Applications of Electricity and Ready Reference Index of the 10 numbers.